Assessment of the 2000 and 2001 Environmental Management Industry

The Times They Are A-Changin'

August 2002

Prepared for
the U.S. Department of Energy
Office of Environmental Management
Office of Science and Technology (EM-50)

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ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COE	U. S. Army Corps of Engineers
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
EBI	Environmental Business International, Inc.
EBJ	*Environmental Business Journal*
EFCG	Environmental Financial Consulting Group
EI	Environmental Information Limited
EM	U.S. Department of Energy Office of Environmental Management
ENR	*Engineering News Record*
EPA	U.S. Environmental Protection Agency
GDP	gross domestic product
M&O	managing and operating
PCB	polychlorinated biphenyl
POTWs	publicly owned treatment works
RBCA	risk-based corrective action
RCRA	Resource Conservation and Recovery Act
SVE	soil vapor extraction
T&M	time and materials
TERC	total environmental remediation contract
TSCA	Toxic Substance Control Act
UST	underground storage tank
WMI	Waste Management, Inc.

EXECUTIVE SUMMARY

In 2001, U.S. companies generated $213 billion in environmental industry revenue (Fig. E.1), with exports representing about 11% of this figure. Overall, the U.S. environmental industry saw growth of 2.1% in 2001 during a year in which the current dollar gross domestic product (GDP) increased 3.4%[1] and the inflation rate was 1.6%[2]. Like many U.S. industries, the environmental industry saw a significant slowdown in 2001 relative to 2000: 2.1% growth in 2001 compared with 6.9% growth realized in 2000. Indeed, 2000 was a relatively strong year with the environmental industry performing better than it had since the early 1990s, due to the strong economy and a major recovery in commodity prices for recyclable materials that buoyed

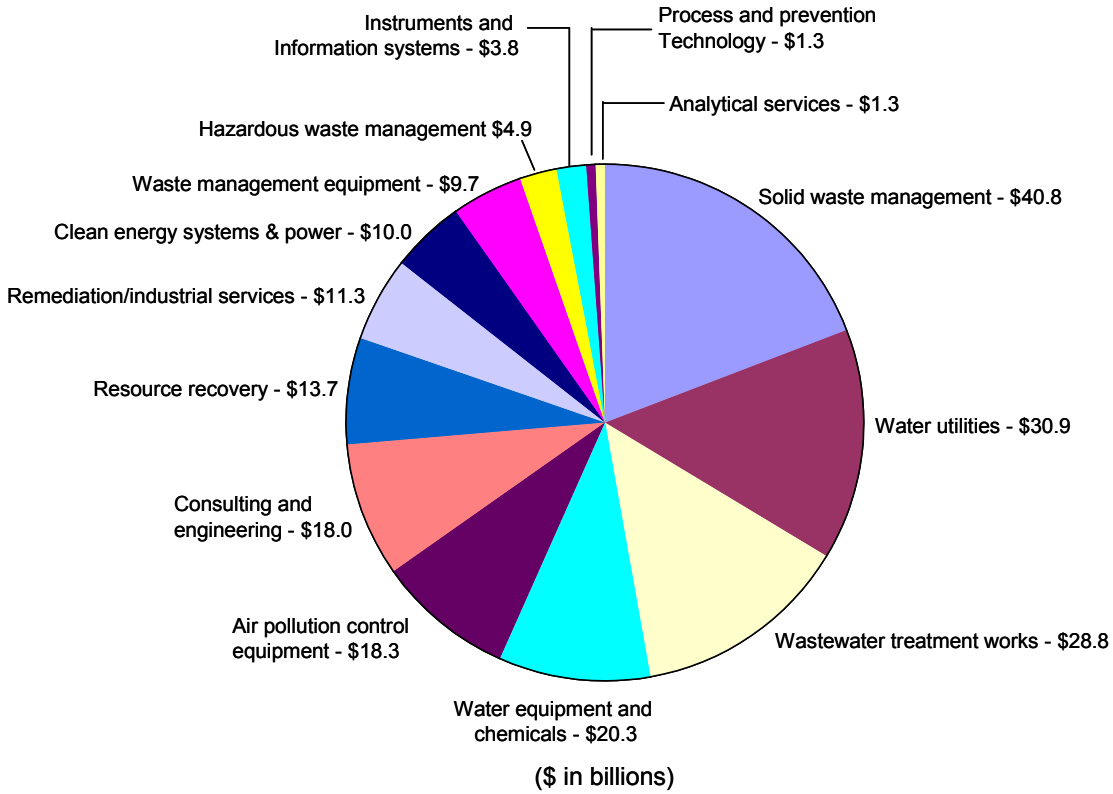


Fig. E.1. The $213.1 billion 2001 U.S. environmental industry (revenues generated by U.S. companies worldwide). *Source*: EBI, Inc., June 21, 2002.

[1] Bureau of Economic Analysis.
[2] Bureau of Labor Statistics.

the resource recovery segment. When the volatile resource recovery segment is excluded, annual growth has been steady between 2% and 4% every year since 1991, reflective of the maturity of the industry.

These aggregated figures disguise important distinctions within the industry, however; some segments are very healthy, others are coasting to a close. Growth exceeding the GDP increase was seen in 7 of 14 industry segments in 2001, while reduced revenues were seen in 3 segments (Fig. E.2). Growth in 9 of the 14 industry segments exceeded the rate of inflation.

The two best-performing industry segments in 2001 were also the strongest performers over the past decade: clean energy systems and power (+16%) and process and prevention technology (+9%). Two segments—solid waste management ($40.8 billion) and clean energy systems and power ($10.0 billion)—accounted for 65% of the overall market growth in dollars. The U.S. water industry—made up of water utilities ($30.9 billion), wastewater treatment works ($28.8 billion), and water equipment and chemicals ($20.3 billion)—accounts for 38% of environmental industry revenues and showed a 3.2% growth over 2000. Market segments that grew faster than the 1.6% rate of inflation are clean energy systems and power, process and prevention technology ($1.3 billion), air pollution control equipment ($18.3 billion), consulting and engineering ($18.0 billion), instruments and information systems ($3.8 billion), solid waste management, wastewater treatment works, water utilities, and water equipment and chemicals.

For three market segments—resource recovery, hazardous waste management, and waste management equipment—revenues declined in

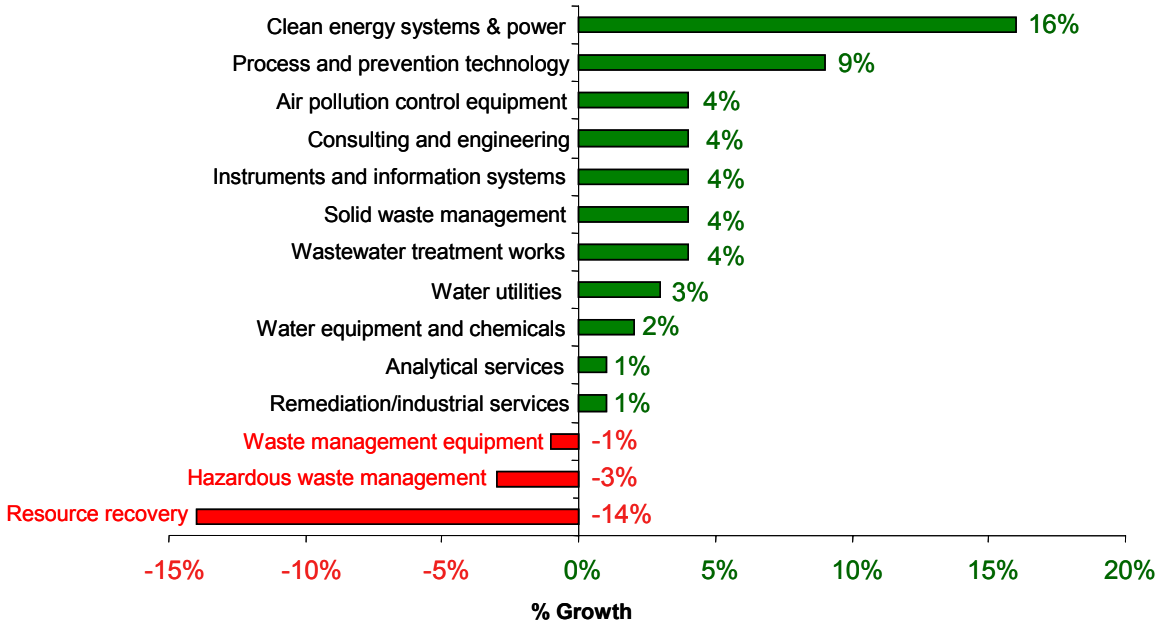


Fig. E.2. U.S. environmental industry revenue growth from 2000 to 2001 by industry segment. Seven industry segments grew faster than the 3.4% GDP increase; three segments declined in revenues.
Source: EBI, Inc., June 21, 2002.

2001. Resource recovery, always a volatile market due to its dependence on spot market commodity materials prices, posted a 14% decline in 2001 on the heels of an 18% gain in 2000. The decline in the hazardous waste management segment, a trend that began in 1993, continued with a 3% decline in 2001, following losses of 4% in 2000 and 7% in 1999. The hazardous waste management segment includes industrial hazardous waste, medical waste, and nuclear waste. Hazardous waste management continues to provide returns that are inconsistent with the significant capital investments made in hazardous waste infrastructure during the early 1990s. While expectations for hazardous waste have not been high for some time now, the low returns on the early 1990s investments represent more nails in the investment coffin that encompasses several environmental market segments. Finally, waste management equipment posted a 1% loss in 2001, most likely a reflection of the 2001 economic downturn.

The remediation/industrial services segment continued its pattern of lackluster performance with 1% growth in 2001 following 1% growth over the entire decade of the 1990s. The U.S. Department of Energy (DOE) Office of Environmental Management (EM) continues to be the largest funding source within the U.S. site remediation market. While the size of the U.S. remediation market has not changed much over the past several years, the nature of the market and the major players continue to change significantly as a result of a combination of consolidation effected through mergers and acquisitions and the marketing success of Bechtel.

The major industry trends are discussed in the following sections.

First, economics rules. Market growth continues to be governed by economics rather than regulations and enforcement, the early environmental market drivers. The 1990s represented a considerable slowing in growth of the U.S. environmental industry overall, as depicted in Fig. E.3. Environmental Business International, Inc. (EBI) reports that the U.S. environmental industry saw 140% and 150% growth in the 1970s and the 1980s respectively. During the 1990s growth had slowed to 37% and looking forward, EBI forecasts 15% growth for the first decade of the 21st century, reflecting the maturity of the market.

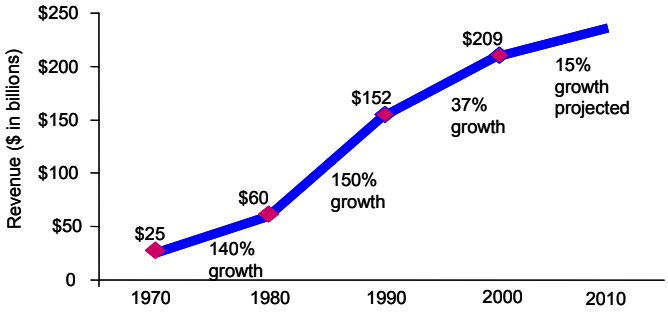


Fig. E.3. Overall growth in the U.S. environmental industry is slowing. *Source*: EBI, Inc.

However, what is forecast as 15% overall growth in the industry is really the combination of two major groups: one group, made up of energy, water, and waste management, is projected to experience growth ranging from 19% to over 250%, while the second group consisting of compliance, remediation, and pollution control is projected to decline 13% to 49%. Moreover, the first group is driven by economics and basic human needs while the latter group is primarily driven by regulation and enforcement. Overall industry figures disguise these important and intrinsic distinctions within the industry, which are illustrated in Fig. E.4.

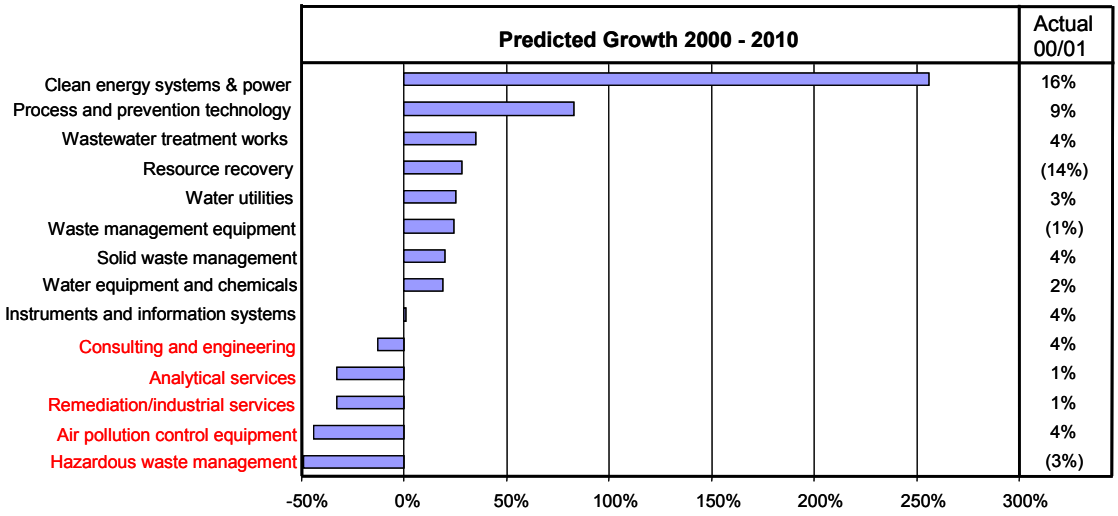


Fig. E.4. Energy, water, and waste management are projected to grow over the coming decade, while compliance, remediation, and pollution control decline. *Source*: EBI, Inc.

Lacking strong regulatory drivers, investment capital to fuel company growth and technological innovation is hard to come by in mature sectors such as remediation, air pollution control, and hazardous and non-hazardous waste management — the strictly commodity markets. Competing companies find little to differentiate themselves from each other. Remediation and hazardous waste companies continue to be plagued by low (if any) profits, declining stock prices, loss of key people as financial rewards are cut, and bankruptcies. Several mid-tier companies turned to higher-risk ventures, such as lump sum design-build and privatization contracts, to enhance dwindling profit margins and market share. High-risk steps have frequently been poorly managed, leading to major cost overruns, failed projects, and failed companies. Corporations once looked upon as industry mainstays (e.g., United Engineers, Rust Engineering, Morrison Knudsen, Westinghouse, Stone & Webster, IT Group) have found themselves with new names requesting Chapter 11 protection or worse, offering themselves on the auction block for a few dollars down and undisclosed amounts of acquired debt. Pricing and risk acceptance, both economic factors, determine the winners and losers in the commodity sectors.

Meanwhile, other sectors that analysts refer to as environmental (but that do not refer to themselves that way) are growing nicely. Clean energy systems and power is an example of a sector where economics is driving rapid growth and creating a sellers' market. Farkas Berkowitz reports, for example, that competition in the engineer/procure/construct market for power services (which uses many of EM's prime contractors) is so tight that some companies, such as Bechtel and the Duke/Fluor Daniel joint venture, refuse to participate in competitive bids and will only enter into negotiated contracts!

Overall, the environmental industry is in a state of evolution. With cleanup markets topping out, a downturn in those industries is projected. Remediation, hazardous waste management, analytical services, and related consulting and engineering are projected to decline, while clean energy, water, and process and prevention technology are projected to continue to grow

based on demographic and economic drivers. Global markets reflect a similar trend, with clean energy, water, and process and prevention technology projected to grow worldwide to meet the demands of growing populations.

Second, the environmental industry is fragmenting, with many companies shunning the environmental moniker. The definition of the environmental industry appears to be the creation of market analysts who have broadly defined the industry and forecasted its overall trends. In actuality, what some analysts refer to as the environmental industry is really made up of a multiplicity of diverse businesses and customer groups, many of whom have no interrelationships with others, and many of whom do not refer to their companies or business sectors as being part of the environmental industry. Examples include water utilities and clean energy systems and power. Moreover, some companies involved in traditional environmental businesses such as remediation derive their major income streams from non-environmental markets. Examples include companies such as Bechtel, Fluor, and Jacobs, the traditional engineer-construction companies that have many environmental contracts but do not perceive that market as being their core market. Accordingly, the second trend is to watch how companies and businesses cast as environmental in this report and the market reports referenced herein differentiate themselves from the environmental industry as befits the times.

Third, "bigger is better" remains an environmental industry mindset. Whether or not the mindset is correct, consolidation continues to be a dominant trend in many environmental industry segments, with a few large contractors monopolizing the market in hopes of squeezing more profit from size. This ongoing trend frequently creates an initial appearance of success. This success is sometimes illusory due to market factors, successful moves by competitors, and the hard realities of using debt financing to make acquisitions — the corporate equivalent of living high (while it lasts) on plastic. Consolidation can be beneficial in some industries, such as solid waste, where a few companies control disposal costs and sufficient demand exists to keep margins high. Consolidation appears to be finally working well in the analytical services sector as well. Consolidation has generally been less advantageous in the remediation and hazardous waste markets.

Bigger is better is true in some cases as illustrated by EM's apparent strong preference for large prime contractor companies. As much as 90% of the total EM contract revenues flow through seven large prime contractors. Bechtel appears to have the greatest win rate of late while the Washington Group International has benefited from its acquisition of Westinghouse's DOE business lines. Other upper echelon DOE contractors include the IT Group (now part of Shaw Group), the Fluor Corporation, and URS in descending order of revenues (Farkas Berkowitz 2000). Few new entrants have found a way to be competitive.

A recent DOE study (DOE 2001) reported that the number of potential bidders for major DOE contracts has diminished from 20 to 30 companies a decade ago to about 10 companies today, with recent procurements for multi-billion dollar site management contracts receiving only one or two proposals (e.g., the Office of River Protection Tank Waste Remediation System, Fernald Environmental Management Project, and Savannah River Site). The reluctance of contractors to bid on major DOE procurements suggests no-bid decisions based upon a combination of low profit margins and futility.

To understand the extent of consolidation, Farkas Berkowitz compared market shares among remediation market competitors in 1994 and 1999. In 1994 the share of the total

remediation market claimed by the top ten companies was 38% (Farkas Berkowitz 1999). In 2000 the top five companies claimed 50% of the market (Farkas Berkowitz 2000). DOE EM contracting in 2000 reached unprecedented levels with 13 major contracts let between January 24, 2000, and January 17, 2001, and Bechtel was awarded 5 out of the 13 contracts. Currently, the top four contractors share over 50% of EM revenues on a net revenue basis (after subcontractors are paid) as illustrated in Fig. E.5. The consolidation of firms and the diversification of firms into other, more profitable commercial markets means that EM now faces a smaller contractor base with less "risk-bearing capacity" as it seeks to accelerate cleanup (Tomlinson and Paterson 2002).

Fourth, the environmental brain drain continues. The exit of talent due to poor industry and company financial performance, aggressive downsizing, baby boomers reaching retirement, and greener grass in other strong markets is leading to a brain and talent drain in the hazardous and remediation markets. While CEOs solely within those markets worry about workforce adequacy, CEOs of major engineering and construction companies are deploying top talent in other sectors that provide growth and opportunity to the workers and the companies. Overall, the historical environmental industry is far less attractive to the best and brightest in the emerging and existing U.S. talent pool than competing opportunities. EM's focus on closure, while the right thing to do, compounds an otherwise already serious problem. How does EM get its contractors

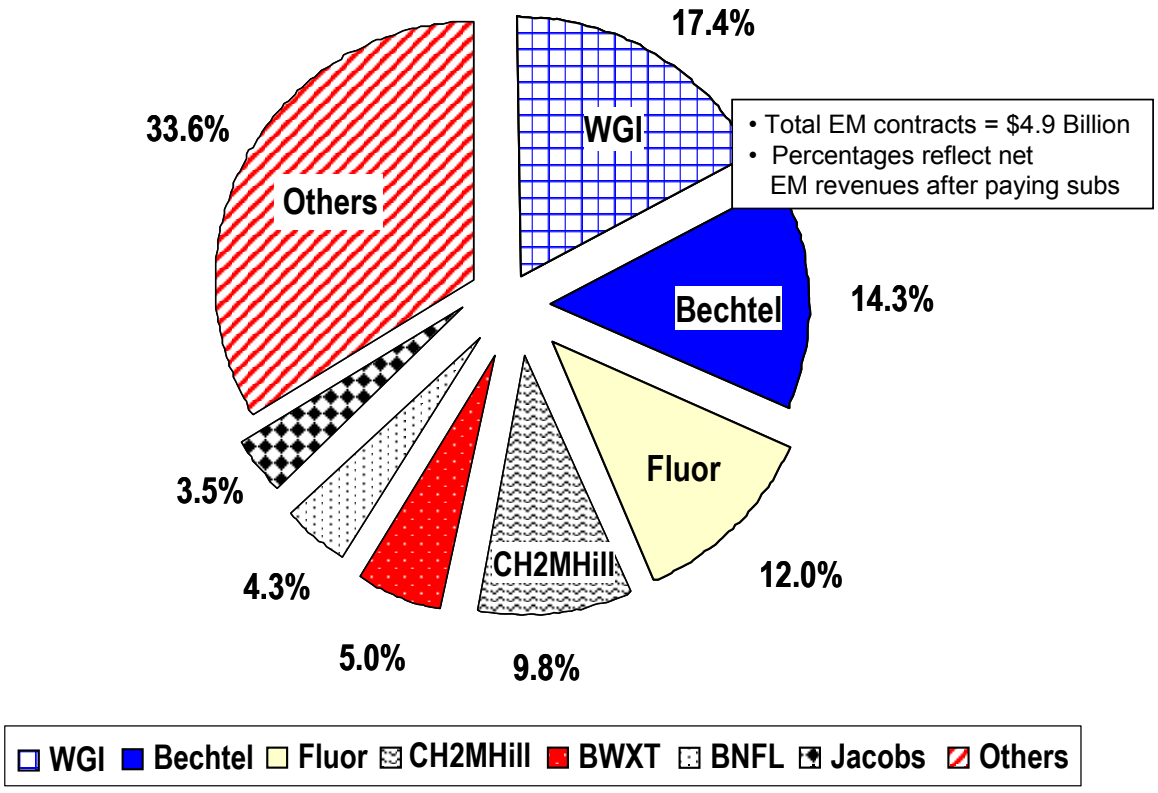


Fig. E.5. Competition among remediation firms is diminishing. Four contractors receive over 50% of EM remediation revenues after paying subcontractors. *Source:* Tomlinson and Paterson 2002.

to bring the best and the brightest project managers and technical managers into its market when their talent can command top prices in competing markets with higher profit margins and better career opportunities? This is likely to become an increasingly serious issue.

Fifth, technology investments focus on pragmatic project needs. In the present EM market in particular and the historical environmental markets overall, technology investments are not occurring on a scale that is likely to make major cost and schedule differences. As a result of the focus on cleanup and closure, current EM prime contractors are not known for technological innovation. The EM contractor mix has changed substantially as its focus matured on actual cleanups and site closures. Old school major-manufacturer-based managing and operating (M&O) contractor companies departed in the late 1980s and early 1990s and have been replaced by engineering and construction firms that bring strong project orientations but limited cutting-edge technology understanding or experience. The project-oriented cleanup focus, while appropriate, must be skillfully managed to avoid impeding the deployment of improved technical approaches that could save DOE money but also place contractor incentives at higher risk.

The low interest in technologies increases the difficulty of finding willing investors to move technologies from the lab to the field or plant. Whether this will impede sectors anticipated to experience strong growth is yet to be determined. At the close of the 1980s, growth in the 1990s was predicted to be much stronger than it came to be. Investors are likely to remain wary of growth predictions in any market that has environmental connotations.

Despite wary investors, there are bright spots for environmental technologies directed at meeting specific needs. For example, in the remediation market, use of *in-situ* treatment technologies that save money on excavation, transportation, and disposal has increased. The analytical services business has seen tremendous productivity growth due to technological enhancements, including robotics and sample preparation technologies for the fixed-base laboratory, as well as field sampling and monitoring technologies. Like the analytical services market, the instruments and information systems segment is being transformed by the shift away from in-laboratory testing toward field analysis, and the increasing use of the Internet for data management.

Sixth, global environmental growth includes off-setting penalties. Environmental markets outside the United States are growing at over three times the rate of U.S. markets. While this offers opportunity for U.S. companies, it also further dilutes the available U.S. talent pool. On the other hand, global margins are lower than commercial U.S. margins and companies are slower to pay. These factors make it a better bet for large companies than small companies where cash flow is frequently a more imminent issue.

Seventh, contract reform is alive but still striving for success. Federal customers and DOE in particular, continue to demand higher levels of performance and accountability through contract reform measures such as performance penalties and rewards. EM is continuing its drive to improve business practices, focusing on performance-based contracting approaches to increase the value received from its contracts and defining proper federal and contractor roles. Stretch goals, found to be an important inducement at Rocky Flats, are spreading throughout the DOE complex. The Top-to-Bottom Review commissioned by the Assistant Secretary for Environmental Management in 2001, highlights the need for DOE to strengthen its business practices and to flow performance-based approaches down through the contractor levels. This is consistent with an overall market trend. In 1994, two-thirds

of remediation contracts were based on time and materials (T&M). The T&M percentage has been sliding since that time as remediation revenues flow more to construction and less toward environmental studies. EBI's 2000 survey indicated that the T&M percentage had dropped to 50%, with 28% lump sum and 22% unit priced contracts making up the balance[3].

The first six trends summarized above place additional burdens on DOE's well-worthwhile contract reform endeavors. The ability to extract higher performance is a function of aggressive competition, and is clearly affected by other market sectors offering faster and higher rewards and competing for top talent. With greener pastures in other growing market sectors luring the best and the brightest and with incentive fees based on results rather than brilliant efforts, what leverage does DOE have to bring smart, innovative solutions and technologies into play? The answers have not yet been evident.

Looking ahead to the future of the industry, increasing demand for energy and water, resource depletion, global climate change, ozone depletion, poor air quality, and rising cancer rates remain major issues, and the environmental industry is beginning to morph towards new avenues of pursuit to address new priorities. It's a market that is transitioning from cleaning up messes to controlling releases to deploying manufacturing techniques that eliminate primary (raw materials), secondary (manufacturing and distribution), and tertiary (end user) pollution sources. Its market segments have leading and trailing edges but, slowly, the market is changing from cleanup to prevent, monitor, and maintain. The industry drivers are continuing to shift from regulatory compliance to economics, environmental stewardship, and sustainability. Europe leads the United States in sustainable economic development, the use of renewable resources, and the protection of nonrenewable resources and the overall environment. It is a matter of everyday business in the European market, an eighth trend that, we hope, will become pervasive in the United States and other global markets as well.

[3] Consulting companies providing risk-related services [e.g., risk-based corrective action (RBCA)] are a factor in T&M revenues maintaining a dominant percentage. EBI forecasts that risk-based services will continue to be a major factor in determining remediation technology applications as well as marketshare over the coming decade (EBI 2001b).

1. OVERVIEW OF THE U.S. ENVIRONMENTAL INDUSTRY

The U.S. Department of Energy's (DOE's) Environmental Management (EM) Office of Science and Technology sponsors this annual overview of the environmental management industry to inform DOE decision makers about the state of the U.S. environmental industry from the industry perspective.

Section 1 provides an overview of the environmental market in the United States in 2000–2001. Section 2 discusses key trends in the industry, while Section 3 provides discussions of each of the environmental industry segments in turn. A mix of 2000 and 2001 data is presented because, while overview data is available for 2001, detailed industry data is not yet available for 2001. In all cases, the most recent data available has been used for this report.

Definitions of the environmental industry and its segments vary widely among analysts. Historically, as a means of maintaining consistency and to present a coherent picture throughout this report, all revenue estimates were derived from a single source: Environmental Business International, Inc. (EBI). EBI publications are an important source of market status information for environmental business managers throughout the industry, providing a valuable source of market size, trend, and state information. Indeed, it has been argued that EBI and a few other analysts "manufactured" the environmental industry, insofar as there is no SIC code for the environment, and what is presented as the "environmental industry" is actually a conglomeration of activities related to the environment that go by different names ranging from "infrastructure" to "regulatory affairs."

The authors of this document have relied extensively upon EBI, its management, and its staff for information used in this report. The authors have also reviewed numerous other references, many of which provide additional industry perspectives based upon the publication's data sources. The authors have endeavored to identify and explain any differences in market projections or surveys where they have occurred. It should be noted, however, that each information source uses its own prescription for slicing the environmental market, which, for the most part, is not fully compatible with other information sources. One of EBI's major contributions has been consistency in approach across the market.

In 2001, U.S. companies generated $213 billion in environmental industry revenue worldwide (Fig. 1.1) and employed approximately 1.4 million people (DOC 2001a). The U.S. environmental industry grew 2.1% in 2001, during a year in which the current dollar gross domestic product (GDP) increased 3.4% (DOC 2002) and the inflation rate was 1.6% (Department of Labor 2002). Like many U.S. industries, the environmental industry saw a significant slowdown in 2001 relative to 2000: 2.1% growth in 2001 compared with 6.9% growth realized in 2000. Indeed, 2000 was a relatively strong year with the environmental industry performing better than it had since the early 1990s, due to the strong economy and a major recovery in commodity prices for recyclable materials that buoyed the resource recovery segment. When the volatile resource recovery segment is excluded, annual growth has been steady between 2% and 4% every year since 1991, reflective of the maturity of the industry.

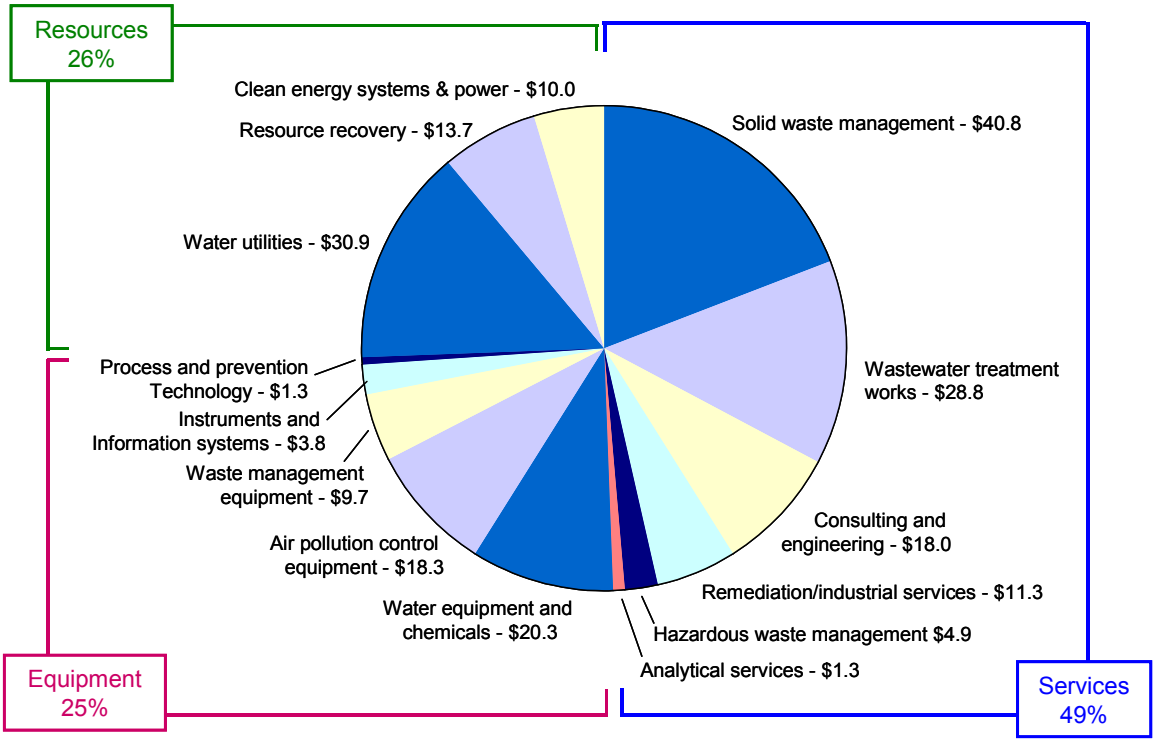


Fig. 1.1. The $213.1 billion 2001 U.S. environmental industry (revenues generated by U.S. companies worldwide). *Source:* EBI, Inc., June 21, 2002.

Growth exceeding the GDP increase was seen in 7 of 14 industry segments in 2001, and reduction in revenue was seen in 3 segments. As Fig. 1.2 shows, 9 of the 14 industry segments grew faster than the rate of inflation.

The two best-performing industry segments in 2001 are also the strongest performers over the past decade: clean energy systems and power (+16%) and process and prevention technology (+9%). The U.S. water industry—made up of water utilities ($30.9 billion), wastewater treatment works ($28.8 billion), and water equipment and chemicals ($20.3 billion)—accounts for 38% of environmental industry revenues and showed a 3.2% growth over 2000. Two segments—solid waste management ($40.8 billion) and clean energy systems and power ($10.0 billion)—accounted for 65% of the overall market growth in dollars. Market segments that grew faster than the 1.6% rate of inflation are clean energy systems and power, process and prevention technology ($1.3 billion), air pollution control equipment ($18.3 billion), consulting and engineering ($18.0 billion), instruments and information systems ($3.8 billion), solid waste management, wastewater treatment works, water utilities, and water equipment and chemicals.

Three market segments— the volatile resource recovery market, hazardous waste management, and waste management equipment—declined in 2001. Resource recovery, always an unpredictable market segment due to its dependence on spot market prices for recyclable materials, posted a 14% decline in 2001

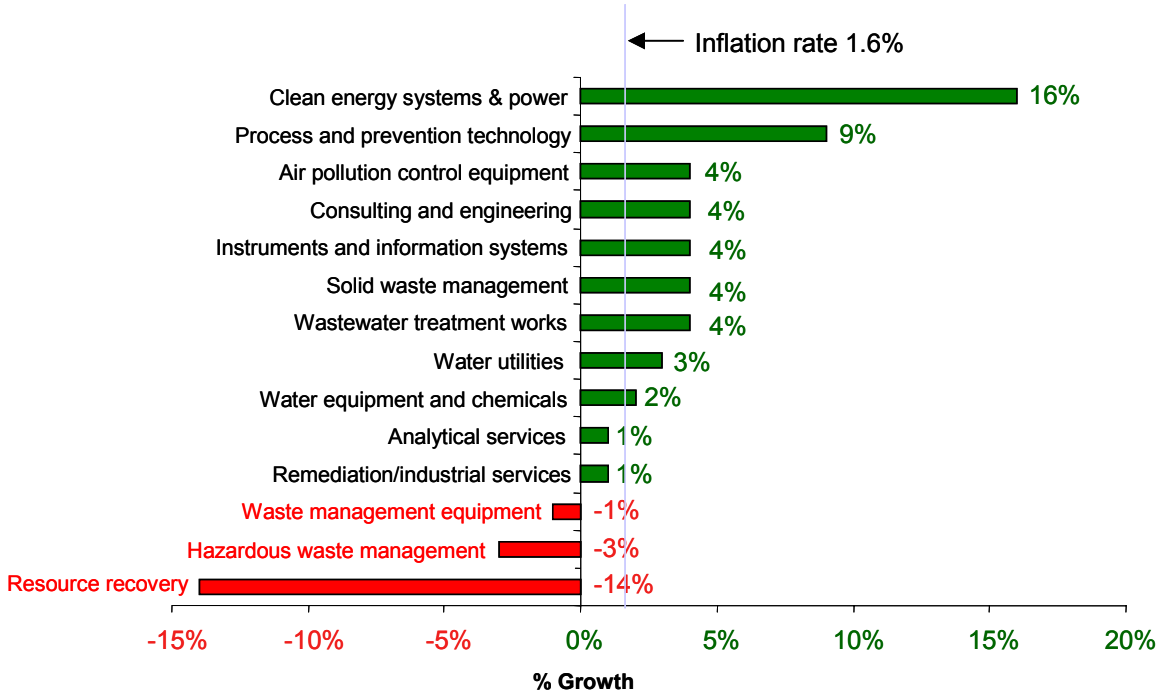


Fig. 1.2. U.S. environmental industry revenue growth from 2000 to 2001 by industry segment. Nine industry segments performed better than inflation; waste management equipment, hazardous waste management, and resource recovery all lost ground. *Source:* EBI, Inc., June 21, 2002.

following the previous year's 18% gain. The decline in the hazardous waste management segment, which began in 1993, continues: this segment posted a 3% decline in 2001, following losses of 4% in 2000 and 7% in 1999. This segment includes industrial hazardous waste, medical waste, and nuclear waste. Finally, waste management equipment posted a 1% loss in 2001.

Meanwhile, the remediation/industrial services segment continued its lackluster performance with 1% growth in 2001 following 1% growth over the entire decade of the 1990s.

Figure 1.3 compares performance over the decade 1990–2000. Hazardous waste management (-19%) and analytical services (-13%) declined over the decade, while remediation/industrial services remained flat (+1%). The largest growth was seen in process and prevention technology (+200%), clean energy systems and power (+100%), instruments and information systems (+80%), solid waste management (+51%) and water utilities (+51%).

Looking back, the decade of the 1990s represented a considerable slowing in growth of the U.S. environmental industry, as depicted in Fig. 1.4. EBI reports that in the 1970s the U.S. environmental industry saw 140% growth, and in the 1980s the industry grew by 150%. By the 1990s, however, growth had slowed to 37%.

Projections for future growth of the U.S. environmental industry continue to reflect the lackluster performance expected of mature markets. EBI projects aggregate growth somewhat less than that of the

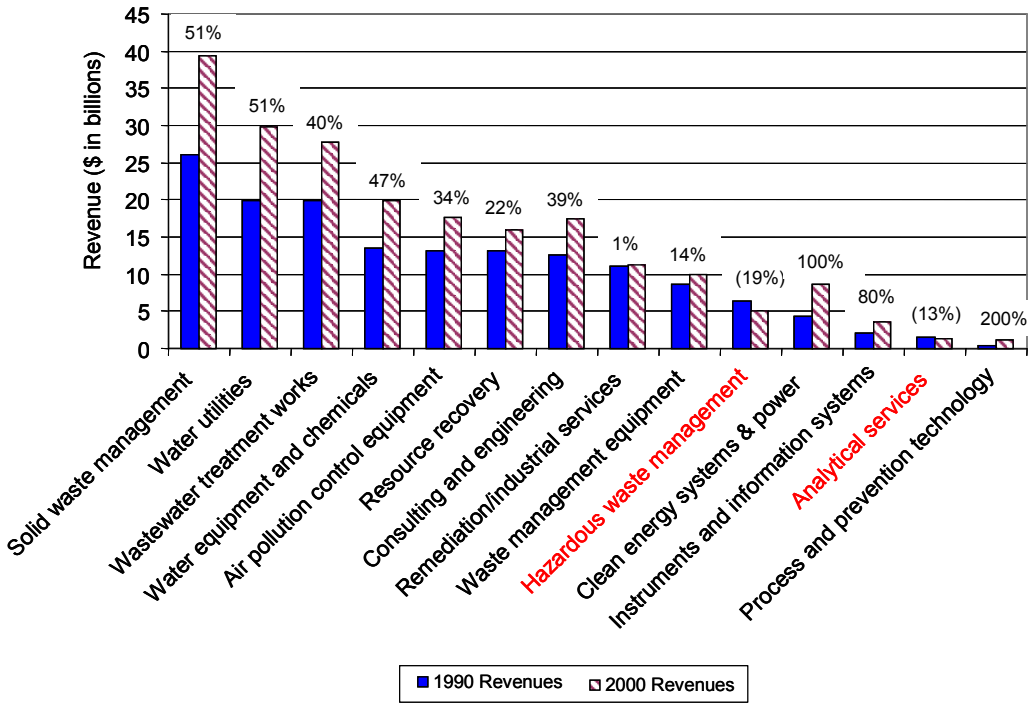


Fig. 1.3. U.S. environmental industry revenue growth from 1990 to 2000 by industry segment. Hazardous waste management (-19%) and analytical services (-13%) declined over the decade, remediation remained flat, while process and prevention technology (+200%), clean energy systems and power (+100%), and instruments and information systems (+80%) saw strong growth. *Source*: EBI, Inc., June 21, 2002.

economy over the next three to five years and a total of 15% growth for the decade 2000 to 2010, the poor performance due principally to over dependence on compliance-related functions.

However, the environmental industry is actually a large mix of activities, with certain segments and niches promising double-digit growth while other sectors go away. As illustrated in Fig 1.5, aggregated statistics on the overall industry disguise important distinctions within the industry. With cleanup markets topping out, a downturn in those industries is projected, while other industries are growing to take their place. Remediation, hazardous waste management, analytical services, and related consulting and engineering are projected by EBI to decline, while clean energy, water, and process and prevention technology are projected to continue to grow based on demographic and economic drivers. Global markets reflect a similar trend,

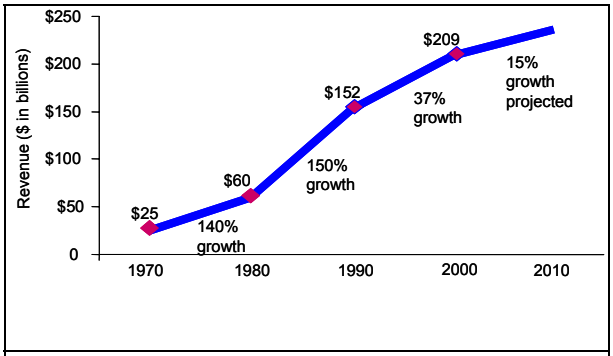


Fig. 1.4. Growth in the U.S. environmental industry has slowed. *Source*: EBI, Inc.

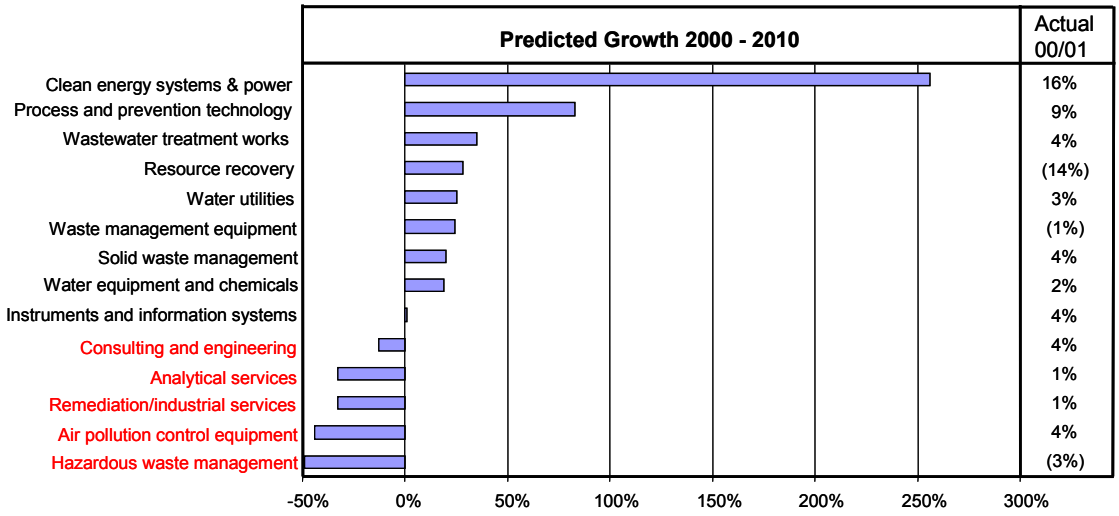


Fig. 1.5. Energy, water, and waste management are projected to grow over the coming decade, while compliance, remediation, and pollution control decline. *Source:* EBI, Inc.

with clean energy, water, and process and prevention technology projected to grow worldwide to meet the demands of growing populations. Thus the industry is characterized by the completion and closure of some activities (e.g., environmental remediation of contaminated sites) and the opening of new avenues of pursuit (e.g., environmental energy sources).

As illustrations of these trends, water and waste infrastructure functions now account for 58% of U.S. environmental revenues, while compliance, pollution control, and remediation account for just 27% (and falling) of the industry. Resource productivity—producing sustainable power and systems and increasing efficiency of methods and materials—accounts for the remaining 14% and holds the potential for enormous growth in the future.

Table 1.1 presents data for 1998–2001 for each of the environmental industry segments, while Table 1.2 summarizes market growth, by segment, over the last decade. Section 3 provides more detailed overviews and discusses key trends and outlooks for the individual environmental industry segments.

Table 1.1. U.S. environmental industry performance, 1998–2001

Industry segment	Revenues (billion $)				Growth (%)		
	1998	1999	2000	2001	98/99	99/00	00/01
Environmental services							
Solid waste management	36.1	37.2	39.4	40.8	3%	6%	4%
Wastewater treatment works	25.9	27.2	27.8	28.8	5%	2%	4%
Consulting and engineering	15.8	16.6	17.4	18.0	5%	5%	4%
Remediation/industrial services	11.0	11.0	11.2	11.3	0%	2%	1%
Hazardous waste management	5.7	5.3	5.1	4.9	-7%	-4%	-3%
Analytical services	1.1	1.2	1.3	1.3	4%	8%	1%
Environmental equipment							
Water equipment and chemicals	18.6	19.2	19.8	20.3	3%	3%	2%
Air pollution control equipment	16.5	17.1	17.6	18.3	4%	3%	4%
Waste management equipment	9.1	9.5	9.9	9.7	4%	4%	-1%
Instruments and information systems	3.3	3.4	3.6	3.8	4%	6%	4%
Process and prevention technology	1.0	1.0	1.2	1.3	8%	12%	9%
Resource management							
Water utilities	28.5	29.4	29.9	30.9	3%	2%	3%
Resource recovery	13.3	13.6	16.0	13.7	2%	18%	-14%
Clean energy systems & power[1]	3.0	3.6	8.6	10.0	18%	NA[2]	16%
All segments	**188.8**	**195.2**	**208.7**	**213.1**	**3.4%**	**6.9%**	**2.1%**

Sources: Data on 1998 and 1999 are from *Environmental Business Journal* 13 nos. 3–4, 2001; data on 2000 and 2001 are from EBI, Inc., June 21, 2002.

Notes:

1. EBI has redefined and renamed this segment; in previous reports, it was the environmental energy sources segment. The segment now includes an additional element–energy systems sales–as well as the sales of actual renewable power generated. The addition of energy systems sales into this market segment beginning with the data for 2000 explains the large jump in revenues from 1999 to 2000.
2. Segment growth is not estimated because the definition of the segment changed from the data for 1999 to the data for 2000.

Table 1.2. U.S. environmental industry growth, 1990–2001 (billions of dollars)

Industry segment	Revenues ($ in billions)				Growth (%)			
	1990	1995	2000	2001	85–90	90–95	95–00	00–01
Environmental services								
Solid waste management	26.1	32.5	39.4	40.8	48%	25%	21%	4%
Wastewater treatment works	19.8	23.4	27.8	28.8	27%	18%	19%	4%
Consulting and engineering	12.5	15.5	17.4	18.0	191%	24%	12%	4%
Remediation/industrial services	11.1	11.1	11.2	11.3	116%	0%	1%	1%
Hazardous waste management	6.3	6.2	5.1	4.9	188%	-2%	-18%	-3%
Analytical services	1.5	1.3	1.3	1.3	133%	-12%	-3%	1%
Environmental equipment								
Water equipment and chemicals	13.5	16.5	19.8	20.3	34%	22%	20%	2%
Air pollution control equipment	13.1	14.8	17.6	18.3	93%	13%	19%	4%
Waste management equipment	8.7	9.8	9.9	9.7	43%	13%	0%	-1%
Instruments and information systems	2.0	3.0	3.6	3.8	197%	51%	21%	4%
Process and prevention technology	0.4	0.8	1.2	1.3	173%	100%	41%	9%
Resource management								
Water utilities	19.8	25.3	29.9	30.9	32%	28%	18%	3%
Resource recovery	13.1	16.9	16.0	13.7	48%	29%	-5%	-14%
Clean energy systems and power	4.3	5.6	8.6	10.0	69%	31%	52%	16%
All segments	**152.2**	**182.9**	**208.7**	**213.1**	**59%**	**20%**	**14%**	**2%**

Source: EBI, Inc., June 21, 2002.

2. INDUSTRY TRENDS

Section 2 provides a look at trends that are shaping the environmental industry. Overall, current trends are shaped by profit, loss, investment, and financing; regulatory drivers have taken a back seat to the economy. The key trends, discussed in Sections 2.1 through 2.7, include economic market drivers; questions regarding what is and what is not within the environmental industry; the continuing evolution of contract reform; consolidation and diversification; brain-drain impacts on workforce adequacy; technology's identity crisis; and the multiple faces of global markets.

Consistent with the target audience for this report being the DOE Office of Environmental Management (EM), we have strived to tie the trend discussions to EM's core business areas to the extent possible. Waning and waxing market trends have the potential to impact EM contract performance insofar as the handful of companies that most of EM's contract dollars flow through also participate in other markets domestically and abroad. For example, to the extent those other markets offer better opportunities for growth and profit than EM contracts provide, they can impact EM's ability to bring the best and the brightest to address its issues.

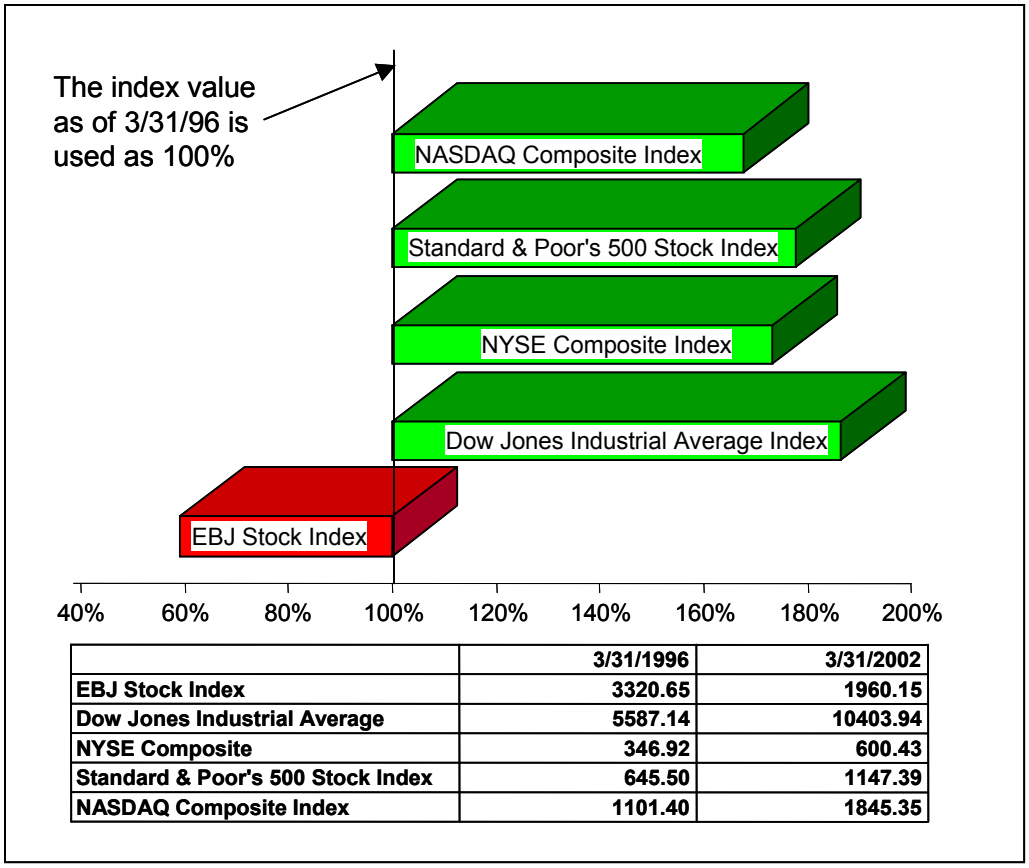
2.1 Economics Rules

Market growth continues to be governed by economics rather than regulations and enforcement, as companies continue to strive for identity, maturity, and profitability. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), Clean Air Act, Clean Water Act, and a host of others have made indelible marks on U.S. government and industry, and environmental costs are now woven into the fabric of every business, either as direct costs or as hidden costs embedded in supplies, utilities, and services. Customers are environmentally savvy and more self-sufficient. Fewer and fewer buyers are willing to pay extra for corporate credentials; for most customers, vendor selections are based on price, reliability, and hands-on understanding of the customer's specific issues. Invariably, environmental companies realizing success today focus on understanding and meeting current customer needs. Grant Ferrier captured the state of the industry very well with his solemn advice: "As much as one would like to be proactive and guide the government or industry client to environmental excellence, the pragmatic approach must be to ride the tide—and be prepared for when the tide changes" (EBI 2001a).

Since the early 90s, the U.S public has been more focused on the economy than the environment, and the Administration and Congress respond to public interests. When Congress allowed the Superfund to fall to the sidelines, it was the litmus test indicating that a new balance point is being sought for environmental matters. The same is true with the U.S. Environmental Protection Agency's (EPA) placing increased reliance on industrial self-policing, and more and more Records of Decision being based on risk-based corrective action (RBCA) remedial cleanup actions. The economy, homeland security, and energy adequacy are more prominent than

environmental matters to most Americans. That translates into decreased regulatory drivers and lean times for sectors reliant on such drivers.

Public offerings and the market have traditionally been used to finance U.S. corporate growth. That requires investors to be interested, however, and many large U.S. institutional investors started to lose interest in environmental companies relatively early in the 90s when profits and growth repeatedly failed to meet analysts' expectations. Institutional investors demand predictable corporate and market behavior in order to make reasoned decisions. Environmental market volatility left many investors cold. Unpredictability, oversupply, diminishing margins, and questionable accounting practices placed environmental companies on the leading edge of the low investor confidence running through Wall Street today. This is illustrated by Fig. 2.1,



	3/31/1996	3/31/2002
EBJ Stock Index	**3320.65**	**1960.15**
Dow Jones Industrial Average	**5587.14**	**10403.94**
NYSE Composite	**346.92**	**600.43**
Standard & Poor's 500 Stock Index	**645.50**	**1147.39**
NASDAQ Composite Index	**1101.40**	**1845.35**

Fig. 2.1. The *EBJ* Stock Index, a measure of environmental company stock value, lost ground to other common market indices over the past 6 years. *Source: Environmental Business Journal* 9, no. 4 (1996) and 14, nos. 5–6 (2002).

which shows how the environmental market, as measured by the *EBJ* Stock Index[4], fared relative to other investment indices over the past six years.

As indicated in Fig. 2.1, the *EBJ* Stock Index lost 41% of its value over the 6-year period 1996–2002 while other common market indices gained between 60% and 90% in value over the same time frame. That loss in market cap value translates into a reduced capacity to fuel growth via equity financing in the market and a greater reliance on debt financing. Moreover, companies reliant on debt financing generally face less favorable costs of money than those with multiple viable financing options — banks offer better terms to companies that do not need the money. As environmental companies financed new growth via debt, less money reached bottom lines, thereby further decreasing investor interest.

As illustrated in Fig. 2.2, some sectors are performing well. The capital value of companies in the water utilities and clean energy sources sectors more than doubled over the past six years. Conversely, early market favorites such as hazardous waste and resource recovery lost nearly three-quarters of their market cap value over the same period.

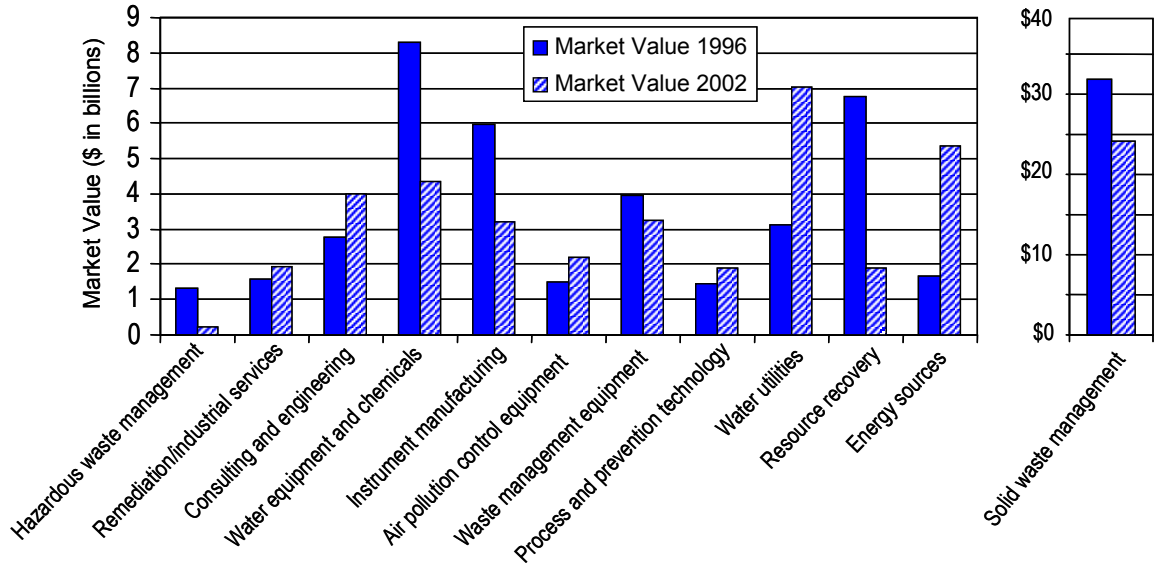


Fig. 2.2. Several of the industry sectors that comprise the *EBJ* Index shown in Fig. 2.1 lost market cap value over the past 6 years. This is a plot of the total capital value of the companies within each industry sector. It excludes the conglomerate sector because much of the market value for the companies in that sector is extraneous to the environmental industry. *Source: Environmental Business Journal* 9, no. 4 (1996) and *Environmental Business Journal* 14, nos. 5–6 (2002).

[4] The EBJ Stock Index is based on a compilation of companies in environmental business fields. It is reported on in each issue of the *Environmental Business Journal*.

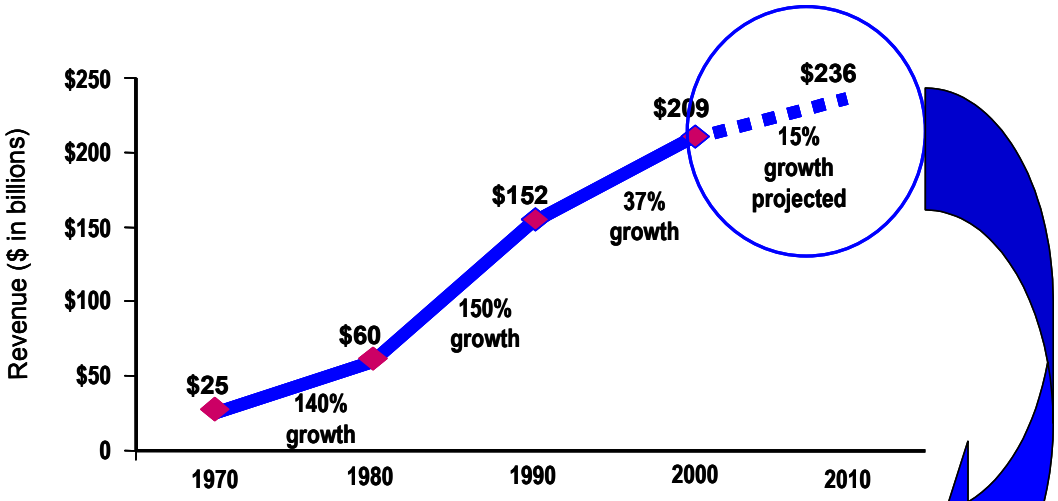
EM is most closely aligned with two traditional environmental market sectors, remediation/ industrial services and consulting and engineering. Both realized moderate growth over the past six years. However some large EM players fell on hard times during that period, apparently due to inadequate risk management. Examples include:

- BNFL's loss of the multi-billion dollar Hanford vitrification plant project, ostensibly due to wildly escalating costs.
- Fluor Corporation and Duke Engineering and Environmental Services (a subsidiary of Duke Power) experienced $120 million in cost overruns on design-build international coal-fired power plants.
- Foster Wheeler's stock tumbled following overruns on fixed-price power plant projects.
- ICF Kaiser's bankruptcy and out-of-control overhead rates.
- Lockheed-Martin's monumental failure on Pit 9, resulting from a major fixed-price bid to perform work that was well outside the company's core competency.
- Raytheon Engineers and Constructors' international project overruns resulting in its sale to the Washington Group International.
- Stone and Webster, a 100-year-old mainline engineering construction firm, filed for Chapter 11 protection due to underestimating lump sum nuclear reactor decommissioning costs.
- Waste Management Federal Services was sold to Duratek to allow its parent, Waste Management, to divest itself of Chem Waste Management and reduce debt by selling Chem Waste Management to Vivendi who declined to purchase if any nuclear strings were attached.

Consulting and engineering firms recorded decade-high profit levels in 2000. Environmental Financial Consulting Group (EFCG) reports that in 2000, consulting and engineering firms reported a median operating margin of 10.2% (EBI 2001a). Whether this is a spike or a trend remains to be seen. Elsewhere, however, the combination of too many hungry and capable competitors is causing belt tightening and rethinking of business plans.

2.2 The Environmental Industry Is Fragmenting, with Many Companies Shunning the Environmental Moniker

In the high growth green market days of the 1980s, many companies were eager to be dubbed environmental and courted the analysts that labeled them as such. Over the past decade as environmental markets flattened, profits dropped, public focus turned towards the economy, and investors sought greener pastures, an environmental industry moniker started to become more of a hindrance than a help. Over



	Market Sector	2000-2010 Change ($ B)	2010 Market Size ($ B)	% Change 2000-2010
Potential Winners	Environmental Energy Sources	+ 10.8	15.0	256%
	Wastewater Treatment Works	+ 10.0	38.4	35%
	Solid Waste Management	+ 7.9	46.9	20%
	Water Utilities	+ 7.6	37.9	25%
	Resource Recovery	+ 4.5	20.5	28%
	Water Equipment & Chemicals	+ 3.8	23.6	19%
	Waste Management Equipment	+ 2.3	12.2	24%
	Process & Prevention Technology	+ 0.9	2.1	83%
	Instruments & Information Systems	+ 0.1	3.7	1%
Also Ran	Analytical Services	(0.4)	0.8	(33%)
	Consulting & Engineering	(2.2)	15.2	(13%)
	Hazardous Waste Management	(2.5)	2.6	(49%)
	Remediation/Industrial Services	(3.7)	7.5	(33%)
	Air Pollution Control Equipment	(7.7)	9.9	(44%)

Fig. 2.3. Long-term environmental industry historical and projected trends: potential winners and also rans. *Source:* EBI, Inc., http://www.ebiusa.com .

the coming decade, the U.S. environmental industry will reach middle age and growth projections for some sectors are, to be blunt, lackluster. Meanwhile, some sectors currently dubbed as environmental by market analysts are poised for exciting growth opportunities and wondering if they are being called by the proper name.

Figure 2.3 depicts the U.S. environmental industry's historical growth over the past three decades and projected growth over the coming decade. What is portrayed as 15% projected overall growth is really the combination of two major groups. One group, made up of energy, water, and waste management, is projected to experience growth ranging from 19% to over 250%, while the second group consisting of compliance, remediation, and pollution control is projected to decline 13% to 49%. Moreover, the first group is driven by basic human needs and economics while the latter group is primarily driven by regulation and enforcement.

Leading the growth is environmental energy sources. Energy security has emerged from a national issue of strategic note to a real-time local and business issue in the wake of California's rolling blackouts, price spikes,

bankrupt utilities, and the accompanying threats to its citizens' quality of life and livelihoods. The aging electric utility infrastructure, questions regarding the ability of natural gas to shoulder the anticipated national energy burden, and a greater press for real-time policies and actions are anticipated to drive this sector upward (EBI 2001c). Continued growth is also expected to occur in water, solid waste, and resource recovery sectors.

The sectors in the second group in Fig. 2.3 simply suffer from diminishing markets. One potential bright spot is that DOE EM, the largest single U.S. source of remediation funding, has opted to move forward more rapidly with its cleanup activities. Initial additional cleanup funding to accelerate cleanup via EM's proposed Cleanup Reform Account should create short-term opportunities. In the long run, however, this strategy will eliminate the major funding source in this market sector by getting the job done. While it is hard to imagine why that is not the right thing to do, it will require many companies to rethink their business plans and find transition routes to more viable markets.

The long-term nature of post-closure risks associated with a wide variety of nuclear sites [e.g., Formerly Utilized Sites Remedial Action Program (FUSRAP) sites, Uranium Mill Tailings Remedial Action (UMTRA) project sites, low-level waste and mixed-waste burial grounds], hazardous sites (RCRA and CERCLA landfill closure sites), as well as a myriad of closed mine and mine tailings sites may create new opportunities for companies in this group.

Over the next decade we will encroach on the fourth quadrant in Fig. 2.4. Remediation opportunities will wane and be replaced with smaller, longer-term opportunities related to post-closure monitoring and long-term stewardship. These are the inevitable consequences of risk-based cleanups, closed land hazardous and nuclear fills, and our inability to clean up every place to greenfield levels and permanently eliminate wastes. This should also open the door to new instruments and measurement technologies coupled with remote information management systems that maintain a vigilant eye over past cleanups for indefinite times into the future.

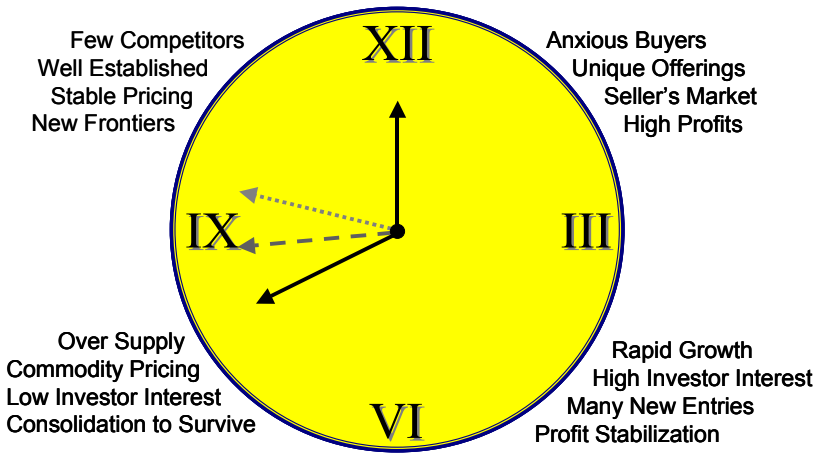


Fig. 2.4. The U.S. environmental industry adjusts for the long haul as some traditional market sectors mature and new opportunities loom on the horizon.
Source: YAHSGS LLC.

2.3 Contract Reform Is Alive but Still Striving for Success

Contract reform is a trend that makes sense and is likely to prevail although it will continue to undergo change as federal customers, and DOE in particular, seek ways to make it work within the DOE complex. The objective of contract reform is the same as with design-build: to make suppliers more accountable for their services and products. The carrot is the availability of greater profit margins if key performance requirements are met or exceeded. The stick includes penalties, such as lost fees, product and service liability, and cost sharing if scheduled milestones or budgets are missed.

Farkas Berkowitz characterizes contract reform (they refer to it as alternative delivery) as a trend presenting opportunities and threats. Farkas Berkowitz predicts that the combined forces of information technology and design-build will accelerate the transformation of engineering from a business that sells hours to a business that sells completed projects. Buyers may benefit by transferring performance risks to the sellers. Sellers may benefit because of opportunities for higher-margin, lump-sum sales. Everyone wins with well-formed deals, and everyone can lose when poor deals are struck as with Pit 9 in Idaho. For lump-sum deals to work well, the buyer needs to know exactly how the job needs to be done, and the seller needs to know exactly how to price and perform the job. Ill-prepared buyers will face large claims and change orders. Overly hungry sellers will face overruns or seek to cut corners.

Farkas Berkowitz notes that the 2000/2001 alternative delivery corporate casualties included ICF Kaiser/Kaiser Group; Stone and Webster; Raytheon Engineers and Constructors (which included United Engineers and Constructors and Rust Engineering via acquisition); and Washington Group International (formerly Morrison Knudson and portions of Westinghouse). All these firms were in positions of financial peril during the past two years resulting in either their sale, Chapter 11, or both (Farkas Berkowitz 2001).

For DOE, contract reform began nearly a decade ago with environmental projects moving from the old-form managing and operating (M&O) contract format (where the contractor enjoyed total indemnification) towards less indemnification and fewer performance risks. Contract reform was a "must do" because the work DOE paid for was not getting done and DOE was forced, under the old M&O contract structure, to pay when M&O contractors gave their best efforts whether or not success ever materialized. "Of the 80 major DOE systems projects initiated between 1980 and 1996, only 15 were even completed, many behind schedule and over cost." (National Research Council 1998).

DOE's early attempts at contract reform had mixed results as previously noted. For example, none of its privatization contracts have gone as smoothly as planned. Pit 9 and the Hanford TWRS vitrification plant privatization contracts were expensive failures while both the Idaho National Engineering and Environmental Laboratory (INEEL) Advanced Mixed Waste Facility and the Oak Ridge Three-Building Decontamination and Decommissioning (D&D) Project required expensive course changes.

EM's push to pay for performance is an important element in establishing site-by-site performance management plans to underpin its Cleanup Reform Account initiatives. But DOE is not yet there on contract reform. It must overcome competition for the best contractors and contractor personnel from commercial markets. It must also overcome internal business practices that are not yet consistent with the

contract reform outcomes DOE wishes to obtain. DOE must find ways to[5]

- identify in specific detail what it wants from each contract during the procurement;
- clearly and accurately set forth its expectations in its statements of work;
- properly allocate project performance risks and align those risks with rewards;
- eliminate unnecessary contractor steps and costs from its procurements;
- stand by its statements of work and oversee, rather than participate in, contractor activities; and
- pay for results at commercial market levels.

DOE's order on project management[6] requires DOE contractors to analyze project technical, cost, and schedule risks and to develop and implement risk mitigation strategies. While this is a positive move on DOE's part to increase planning and accountability, used in combination with DOE's fragmented approach to contract management (each site implements contract reform differently), it has in some cases resulted in contractors opting for technical approaches that are less favorable to DOE but more protective of the contractor's fee (DOE OMBE 2001).

Ironically, in the late 80s when the environmental cleanup market loomed large on the horizon, engineering construction firms argued that they, not hazardous waste management firms, should lead cleanup activities since, ultimately, those activities led to construction-like activities. Today, as the hazardous waste firms are hungry for work, the engineering construction firms perceive greener pastures in their traditional market sectors.

Figure 2.5 helps illustrate DOE's difficulty competing for top contractors and contractor personnel in the commercial marketplace. One remarkable aspect implicit in Fig. 2.5 is that over 90% of EM's cleanup budget[7] flows through just seven firms. That pretax profits are at such low levels in a market sector with such limited competition is troublesome. Figure 2.5 helps demonstrate why some key DOE contractors are in financially weak positions that diminish their capabilities to attract and retain top talent (DOE 2001).

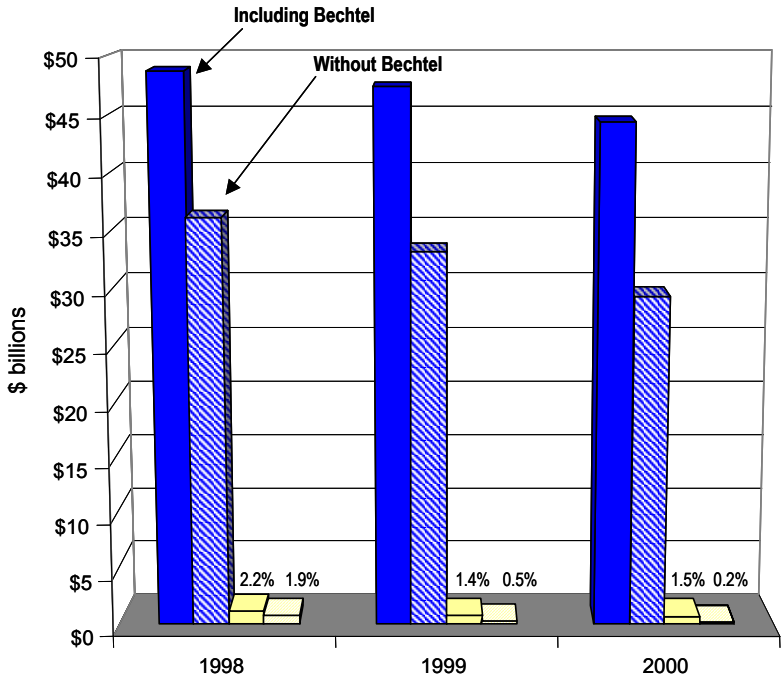
Looking beyond DOE, the Department of Defense (DoD) has its own form of environmental contract reform in the U.S. Army Corps of Engineers (COE) called total environmental remediation contracts (TERC), a contract form that combines consulting, engineering, and construction into a single contract. The TERC was a revolutionary contract form for DoD and CERCLA cleanups in general when first announced by the COE in the early 90s in parallel with DOE's ERMC contracts at Hanford and Fernald. It has worked well for the COE who announced in 2001 that it is issuing a new round of TERC request for proposals from multiple COE offices across the nation (Farkas Berkowitz 2001).

The U.S. Navy introduced guaranteed fixed-price remediation contracting to its cleanup arsenal in 2000 for the remediation of the Charleston, S.C., shipyard. Under the Navy's concept, payments are made only when parcels of the shipyard are released for redevelopment. The Navy is also experimenting with an environmental maintenance contract concept in the Southwest division to operate and maintain

[5] Derived in part from W. Howes, D. Berg, and A. Paterson, "Analysis of the DOE Contractor Base (v2000)," Nov. 5, 2001, as well as from personal communications with industry and DOE executives.

[6] U.S. Department of Energy, DOE Order 413.3, October 2000.

[7] A. Paterson, July 5, 2002, Advance copy of *Environmental Business Journal* article, "*New Approach" Unveiled for DOE Weapons Cleanup."*



	1998	1999	2000
Revenues (with Bechtel)	$48,758 M	$47,457 M	$44,449 M
Revenues (without Bechtel)	$36,158 M	$33,267 M	$29,341 M
Pre-Tax Profit (with Bechtel)	$1,083 M	$674 M	$664 M
Pre-Tax Profit (without Bechtel)	$683 M	$174 M	$64 M

Fig. 2.5. DOE EM contractor fee rates are extremely low and indicate that rigorous contract enforcement techniques, such as are deployed by Bechtel, are worth the contractor's effort. *Source:* W. Howes, D. Berg, and A. Paterson, "Analysis of the DOE Contractor Base (v2000)," November 5, 2001.

environmental systems, emergency response, and compliance activities within a single contract vehicle.

The U.S. Air Force let 12 contracts for remediation and environmental compliance in 2001. The best performers have a greater opportunity to share in the 7-year, $480 million contract pot, with the top performer receiving $200 million. Thirteen more contracts totaling $750 million were let in 2001 using the same performance-reward concepts.

On the commercial side, Farkas Berkowitz reports that the engineer/procure/construct market for power services (which uses many of EM's prime contractors) is so tight that some companies (Bechtel, Duke/Fluor Daniel) refused to partake of competitive bids and would only enter into negotiated contracts. This is an interesting instance where the commercial market is deploying a contract reform-like strategy (design-build) in a market so seller constrained that (for now) high-caliber sellers can avoid competitive bids.

2.4 Bigger Is Better Remains an Environmental Industry Mindset

A "bigger is better" mindset, right or wrong, has been commonplace in the remediation, consulting and engineering, solid waste, and other environmental market sectors for over a

decade. Alan Farkas (of Farkas Berkowitz) notes that in some cases, size is important—the DOE EM market being a case where prime contractors have to be big companies. But while overall statistics indicate acquisitions remain strong, companies have become much more selective in their acquisitions (EBI 2002a).

Consolidation and diversification typically come about for the same reasons and use the same mechanisms: acquisitions and mergers. The difference is that diversification typically expands the customer base through greater service lines or geographic presence, while consolidation combines former competitors. Both are driven by a quest for higher revenues, lower costs, and stabilizing (or setting) pricing. EFCG reports that while the industry reports an average internal growth rate of 4%, the growth expected to come from acquisition is 10%. They conclude that most of the growth for environmental firms is coming from acquisitions, not internal growth (Zofnass and Avelini 2000).

Industry survey information published in 2000 by Environmental Information Limited (EI), a privately held research firm that monitors environmental business markets and trends, indicated that approximately half of the environmental service firms doing business in 1993–1994 had gone out of business or had been acquired by 2000. Furthermore, all regions of the United States have seen between 43 and 55% of environmental service firms close their doors.

EFCG projects a strong acquisition market through 2001 as indicated in Table 2.1. Recent acquisitions of note include:

- Washington Group International's acquisition of Raytheon, a move that led WGI to the portals of bankruptcy,
- MACTEC's acquisition of Harding Lawson Associates and Law Companies Group,
- Earth Tech's acquisition of ICF Kaiser,
- Montgomery Watson's acquisition of Harza,
- AECOM's acquisition of Metcalf & Eddy,
- URS' acquisition of Dames & Moore, a company that was itself previously acquisition-active,
- Waste Management's (Houston, TX) acquisition of Waste Management (Oakbrook, IL), and
- Duratek's acquisition of Waste Management Federal Services, a subsidiary of Chem Waste Management; a move that enabled Videndi to acquire Chem Waste Management from Waste Management (Houston, TX) without nuclear strings attached.

A sobering note that is consistent with several of the environmental firms that have previously gone on acquisition binges is that, industry-wide, most acquisitions fail. According to Steve Maxwell, TechKNOWLEDGEy Strategic Group, "Deals fail for two broad reasons. First, the acquirers have no strategy in place—they just buy to get bigger. Second, and more often, there was a strategy, but no success in implementation." (EBI 2002d). The difficulty of merging corporate cultures is frequently underestimated and is one of the most common causes of failed mergers and acquisitions.

Table 2.1. Merger and acquisition activity in the environmental consulting and engineering business, 1998–2001

	1998	1999	2000	2001
Number of firms making acquisitions	49	30	38	50
Number of acquisitions	86	52	60	76
Percent of firms making acquisitions	28%	19%	25%	32%
Percent revenue growth from acquisitions	10%	5%	5%	5%
Top 20 firms as % of industry revenues	65%	67%	70%	69%

Source: Environmental Business Journal 14, nos. 1–2 (2002), attributed to EFCG; based on data from the EFCG 2001 survey of 168 firms. Figures from 2001 are estimates that have not yet been verified by company reports.

Several previous acquirers have slowed their acquisition activity, at least temporarily. In 2000, the big three in the solid waste sector (Waste Management, Republic, and Allied Waste) shifted their focus from acquisitions to operational improvements, debt reduction, and cash flow improvement (Szuper 2001). URS also announced that it has ceased making acquisitions, at least temporarily, to pay down debt. Farkas Berkowitz speculates that URS may "rationalize its holdings with selected divestures." Duratek, which was active in acquisitions in the late 1990s and 2000, acquiring such companies as SEG, Hake, and Waste Management Federal Services, is also focusing on operational improvements, has lost several senior managers to other companies, and appears to have not recognized the returns on some acquisitions that it initially banked on.

Remediation firms are available for acquisition but buyers are scarce[8]. Roy F. Weston, a major consulting engineering and remediation firm, sought a buyer to divest itself from the Weston family but had to turn to private equity as no engineering firm buyers came forward. The same was true of RETEC (formerly ThermoRetec) which was divested by ThermoElectron and turned to private equity, again due to a lack of interested corporate buyers.

The IT Group is an interesting case history on why bigger is not necessarily better in a declining industry. With money initially from the Carlyle Group, IT acquired ten companies from 1997 through 2001 for well over a billion dollars. Much of the acquisition burden was ultimately debt financed. With a debt burden too great to manage, IT announced in June 2001 that it had retained an investment broker to divest some units to pay down debt and in January 2002 agreed to be acquired by the Shaw Group for $105 million and the assumption of "certain liabilities" (EBI 2002a).

2.5 The Environmental Brain Drain Continues

Managers continue to express concern about the difficulty of maintaining a workforce with the necessary skill mix. Farkas Berkowitz reports that many CEOs see attraction and retention of talented professionals as their most important challenge, in large part because their growth is constrained by an inadequate workforce of qualified professionals to adequately serve customer needs. The EFCG annual survey of environmental firms continues to indicate that personnel issues rank as number one on a list of

[8] By contrast, transportation and water quality firms are sought after by companies seeking to diversify into those markets, but sellers are scarce.

what worries CEOs (EBI 2001a). "Our best project managers are being sucked away," said William L. Robertson, CEO of Roy F. Weston, Inc., pointing particularly to clients and new competitors such as financial management firms (Rubin et al. 2000).

The same is true on the federal side, particularly for agencies with specialized needs and knowledge. DOE faces losing a substantial fraction of its managers and skilled professionals to retirement and does not appear to yet have adequate programs to make up for any resulting deficits. A challenge DOE faces is the need to compete for top talent with the commercial sector where contracts and fees are faster and less expensive to obtain. "Companies have better things to do in the commercial sector than DOE work," comments Paul Zofnass of EFCG. This is well illustrated by Fig. 2.6, which puts the hazardous and remediation market in perspective with other U.S. markets vying for top talent.

2.6 Technology Investments Focus on Pragmatic Project Needs

While technology underpins the U.S. advantage in many environmental markets and can be critical to identifying more competitive approaches to carry out environmental work across multiple market sectors, technology development requires investment. Environmental technologies are not perceived as particularly good money makers and have not attracted significant public or private investment in recent years. This is in part due to famous technology investment failures, such as Molten Metal, and in part due to market trends and bottom lines that investors do not find compelling. Moreover, Standard & Poor indicates credit trends to be mixed in the environmental services sector, which can make internal R&D more difficult to finance.

Internal investment into environmental technologies is low and declining. The relatively slow adoption of new technologies reduces investment returns, which has resulted in driving

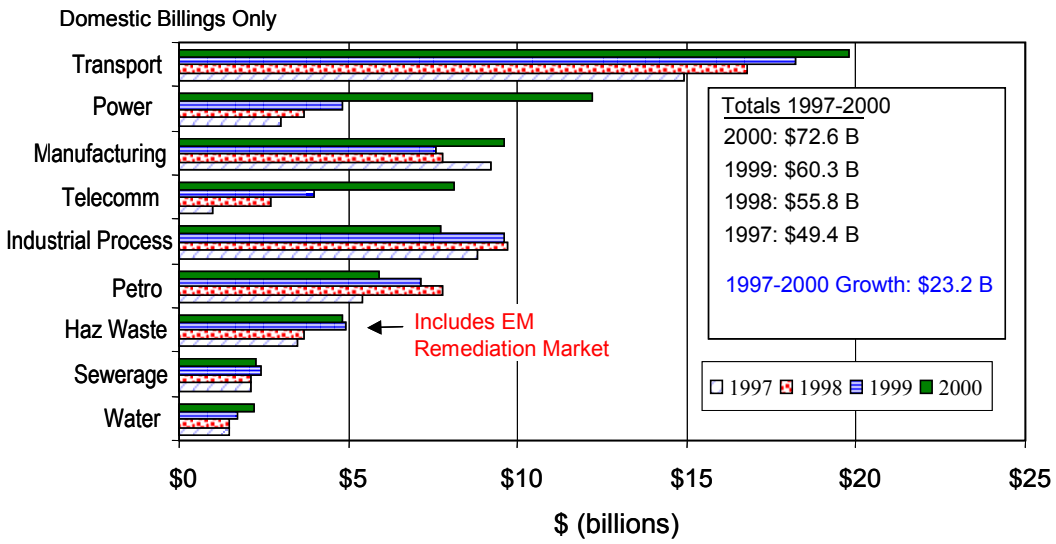


Fig. 2.6. Larger commercial construction markets are growing faster and offer less risk than the hazardous waste (including EM remediation) market. *Source:* W. Howes, D. Berg, and A. Paterson, "Analysis of the DOE Contractor Base (v2000)," November 5, 2001.

many technology companies away from environmental markets (DOE 2001). Moreover, funding tends to be focused on demonstrations of proven technologies that are likely to be successfully applied in new ways rather than higher-risk investments to develop new technologies straight from the lab.

Within EM, the trend over the past decade has been for the prime contractor mix to transition from high asset manufacturing companies with strong R&D capabilities (4% of sales) to low asset engineering and construction firms with small (1% of sales) R&D. This trend is illustrated in Table 2.2 and is a result of EM's matured focus on actual cleanups and site closures. The project-oriented cleanup focus, while appropriate, must be skillfully managed to avoid impeding the deployment of improved technologies that could save DOE money but also place contractor incentives at higher risk.

Table 2.2. EM's contractor base has transitioned from major manufacturing firms with strong R&D capabilities to engineering and construction firms with strong project orientations

Prior DOE Contractors Manufacturing Firms	2000 Sales	12/31/00 Assets	Current DOE Contractors Engineering Firms	2000 Sales	12/31/00 Assets
Duke Energy	$49.30	$58.20	Bechtel	$15.10	$3.00
Dupont	28.30	39.40	Fluor	10.00	3.60
Lockheed Martin	25.30	30.30	SAIC	5.53	4.40
Honeywell/Allied Signal	25.00	25.20	Jacobs Engineering	3.14	1.38
Dow Chemical	23.00	27.60	WGI-Westinghouse (B)	2.41	1.10
TRW	17.20	16.50	McDermott / BWXT	1.88	2.00
Rockwell	7.15	6.40	CH2MHill	1.70	0.52
EG&G (Perkin-Elmer)	1.70	2.23	ICF Kaiser (B)	0.60	0.00
Total ($ billions)	**$176.95**	**$205.83**	**Total ($ billions)**	**$40.36**	**$16.00**
			(B) = in bankruptcy		
Combined R&D Investment	**$7.08**	**4.0%**	**Combined R&D Investment**	**$0.40**	**1.0%**

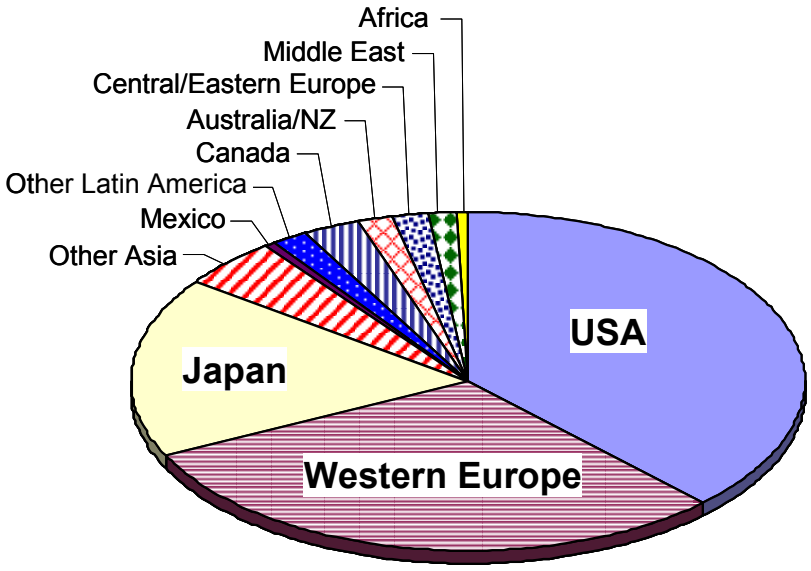
Source: Howes, Berg, and Paterson 2001.

While technology experts predict that EM could save more than $500 million annually through a more optimal use of technologies in cleanup programs (DOE OMBE 2001), technology investment must be skillfully melded with contract reform to achieve these potential gains. The contract reform mechanisms sought within EM focus on paying for results. A cleanup contractor's willingness to deploy an advanced cleanup technology requires that the benefits achieved through deployment (e.g., reduced cost and schedule) substantially outweigh the down-side risk of failure and recovery due to the greater uncertainties associated with new technologies. The exception would be demonstration projects structured so that the prime contractor's fees would not be affected by success or failure of the demonstrations but the outcome of several demonstrations would lead to a more effective path forward.

2.7 Global Environmental Growth Includes Off-Setting Penalties

Non-U.S. environmental markets are growing more rapidly than those in the United States, with the total global market increasing from $499 billion in revenues in 1999 (2.9% growth over 1998) to $522 billion in 2000 (4.6% growth

over 1999). It is projected that the global market will grow to $562 billion by the year 2004 and $615 billion by 2008. The late 90s slowdown in the U.S. environmental market caused many companies to more aggressively market their products and services internationally in the global environmental marketplace. This resulted in U.S. environmental exports more than doubling from $13.4 billion in 1996 to $28.5 billion in 2000 based on U.S. Department of Commerce, International Trade Administration statistics (DOC 2001a). Exports account for 11% of the total revenue of the U.S. environmental industry and support 145,000 U.S. jobs. The geographic distribution of the $522 billion global environmental market is illustrated in Figs. 2.7, and 2.8 shows the distribution of global environmental revenues by product.



Market Size in 2000 ($ billions)			
USA*	$198	Canada	$13
Western Europe	$156	Australia/NZ	$9
Japan	$91	Central/Eastern Europe	$9
Other Asia	$24	Middle East	$7
Mexico	$2	Africa	$3
Other Latin America	$9		

* Revenues from U.S. customers by companies from all nations

Fig. 2.7. The $522 billion 2000 global environmental market. *Source:* G. Ferrier, "U.S. Market Assessment & Opportunity Review for Environmental Firms," March 2002.

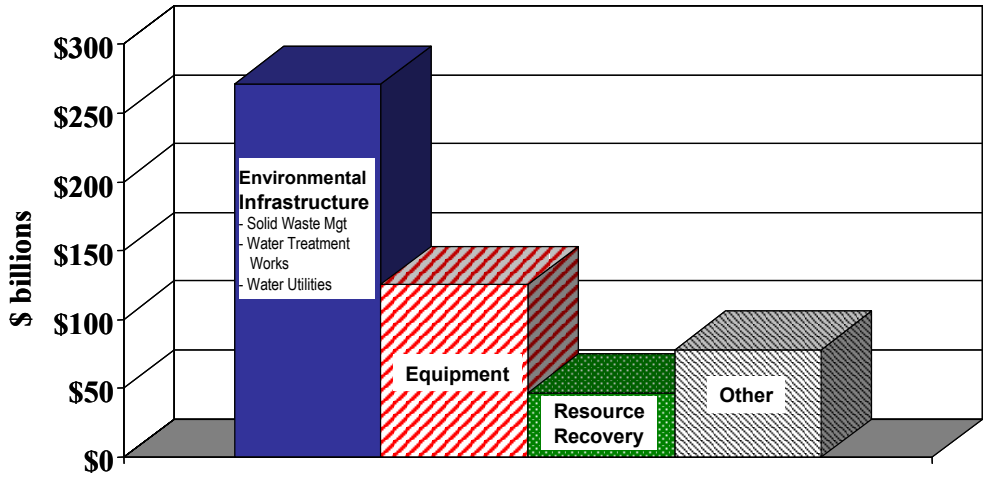


Fig. 2.8. Global market revenue distribution. *Source:* G. Ferrier, "U.S. Market Assessment & Opportunity Review for Environmental Firms," March 2002.

The global environmental market is growing at over three times the rate of the U.S. environmental market, as illustrated in Fig. 2.9, with growth projected to be greater in emerging economies than in developed countries. The United States, Western Europe, and Japanese markets represented approximately 85% of the global market in 2000, down slightly from 86% in 1999. Linda Conlin, Assistant Secretary for Trade Development, International Trade Administration, reports that the World Trade

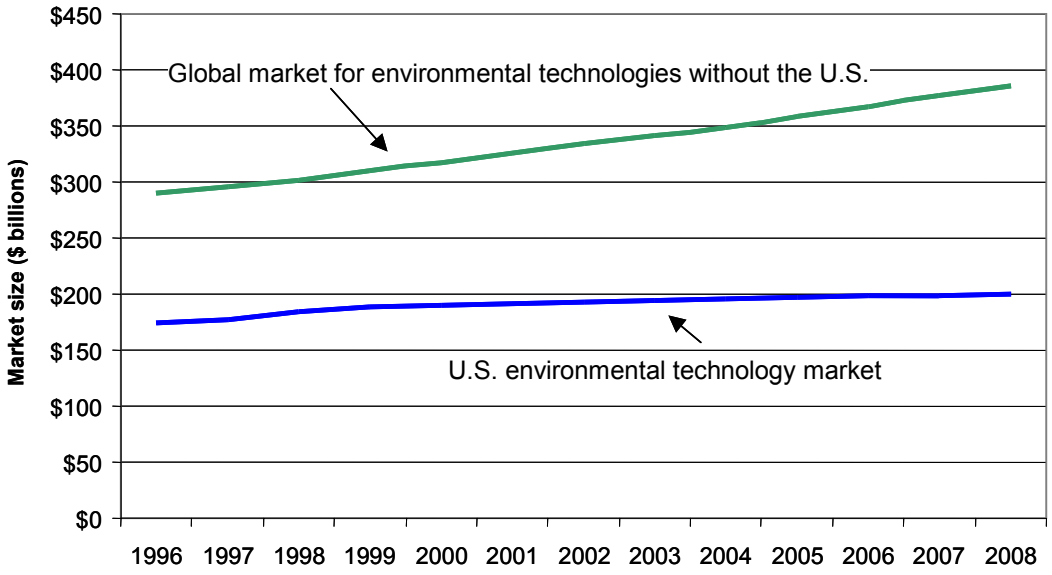


Fig. 2.9. Global markets for environmental technologies are growing more than three times faster than markets in the United States. *Source:* U.S. Department of Commerce, International Trade Administration, Office of Environmental Technologies Industries, http://web.ita.doc.gov/ete/etinfo.nsf, September 2001.

Organization and Free Trade Area of the Americas negotiations will allow more U.S. firms to gain increased access to global markets, particularly in emerging economies, where demand for environmental technologies is rapidly expanding. She cites trade liberalization with Mexico, in particular, as an example of expanded opportunities for the industry. U.S. environmental exports to Mexico grew by 385% between 1993 and 2000, due primarily to the increased growth generated by the North American Free Trade Agreement (Conlin 2001).

Is the allure of the global market retaining its hold on U.S. companies? A recognized downside of overseas markets for U.S. companies is that profit margins tend to be substantially lower for international contracts than for domestic contracts. This is attributable to the greater necessity for management oversight, delayed payment schedules, and greater capital investments. Paul Zofnass, president of EFCG, indicated in a recent interview with *Environmental Business Journal* (*EBJ*) that U.S. companies have "no mad drive to go overseas." Zofnass indicates that, although overseas margins are improving, they do not equal those obtainable domestically. Zofnass believes that the overseas market will be targeted by large companies that want or have international capabilities but concludes that the overseas market is less attractive for smaller firms because "the cost of doing business overseas is so much greater than doing business at home, and you have to amortize that cost over a much larger base than the smaller firms can provide" (EBI 2002a).

The U.S. industry export performance and trade balance trends are shown in Table 2.3 (specific export data for 2000 are not available at the writing of this report). The United States remains the largest single market for environmental technologies and services in the world. While the United States is the leading producer of environmental technologies and services, it exports only about 11% of its environmental output; in contrast, key competitors (Japan, Germany, and Great Britain)

Table 2.3. U.S. environmental industry export performance and trade balance, 1993–2000 (billions of dollars)

	1993	1994	1995	1996	1997	1998	1999	2000
U.S. industry revenues[a]	165	172	180	181	186	189	195	209
U.S. exports[c]	9.4	11.1	14.2	15.6	18.2	18.9	21.3	N/A[d]
% exports[c]	5.7%	6.4%	7.9%	8.6%	9.8%	10%	11%	N/A[d]
Global market	423	440	453	464	474	485	499	522
U.S. market[b]	160	167	172	174	178	182	189	198
Non-U.S. market	263	272	281	290	296	303	311	324
Growth in U.S. exports	20%	18%	28%	10%	17%	3.8%	13%	N/A[d]
U.S. share of non-U.S. market	3.6%	4.1%	5.1%	5.4%	6.1%	6.2%	6.9%	N/A[d]
Trade surplus	4.6	5.3	7.6	7.1	8.5	8.0	7.3	N/A[d]

Sources: U.S. Department of Commerce, International Trade Administration, at http://www.ita.doc.gov; *Environmental Business Journal* 12, nos. 9–10, 2000; Ferrier, G., "U.S. Market Assessment & Opportunity Review for Environmental Firms," March 14, 2002. Each of these sources is using data from EBI.

[a] Revenues generated by U.S. companies worldwide.

[b] Revenues from U.S. customers by companies from all nations.

[c] Exports do not include ownership of overseas companies but do include repatriated profits.

[d] As of the date this table was prepared, the 2000 export numbers have not yet been published by EBI, the source used for year-to-year consistency in this report.

traditionally have exported over 20%. Those nations continue to penetrate the large U.S. environmental market through partnerships, acquisitions, and direct sales. Vivendi's acquisition of many of Chem Waste Management's (nonnuclear) business lines is an example of foreign penetration of U.S. environmental companies.

3. U.S. MARKET ASSESSMENT

This section discusses the individual environmental industry market segments. Each subsection presents a market overview followed by discussions of trends and outlook in that industry segment.

3.1 Remediation/Industrial Services

Market Overview

The remediation/industrial services market is essentially flat, but this disguises important changes that are occurring in the nature of the market and the major players. As defined by EBI, the remediation/industrial services segment consists of two major subsegments:

- *Site remediation* involves physical cleanup performed at contaminated sites by remediation contractors. Revenues from remediation services totaled $6.3 billion in 2000.
- *Industrial services* include facility cleaning services (refinery turnaround; cleaning, repair, and maintenance of above-ground storage tanks; and cleaning services for containers, manufacturing facilities, and industrial or commercial sites like airports) and abatement services for ridding buildings of hazardous materials (such as asbestos and lead paint) and for radon mitigation. Industrial services revenues were $4.9 billion in 2000.

The $11.3 billion combined remediation/ industrial services segment continued its pattern of lackluster performance with 1% gain from 2000 to 2001 following 1% growth over the entire decade 1990-2000. The market trend for remediation/industrial services has been essentially flat over the past decade (and has lost ground to inflation over that time) as depicted in Fig. 3.1. Revenues from remediation generated by the analytical services, consulting and engineering, instruments and information systems, and waste management equipment segments bring the total U.S. revenues associated with remediation/industrial services to $17.0 billion, or 8% of the 2001 $213.1 billion environmental industry total.

When looking at the site remediation subsegment, EBI reports slow growth beginning in 1998, with 3% growth from 1998 to 1999, followed by 2% growth from 1999 to 2000. Other industry sources report somewhat different data: Farkas Berkowitz & Company, a Washington, D.C., consulting firm that specializes in the environmental industry, prepares an annual environmental industry report that, like EBI, provides a year-to-year benchmark of industry trends. Farkas Berkowitz uses different source information than EBI and also uses somewhat different industry sector breakdowns. Farkas Berkowitz draws heavily upon data from the *Engineering News Record* (*ENR*) Top 500 Design Firm Survey. They adjust ENR survey data for anomalies, isolate revenues from U.S. projects, discount gross revenues to net, and they adjust for firms that are too small to be included in the ENR surveys. Farkas Berkowitz reports that the remediation services market declined slightly in 2000 but, within the error margin for the survey, has been essentially flat over the past two year period (1999 and 2000) (Farkas Berkowitz 2001).

Based on data from EBI and as indicated in Fig. 3.2, remediation construction revenues increased 5% in 1999 and 2% in 2000, to $3.6 billion, while other remediation activities grew 1% in

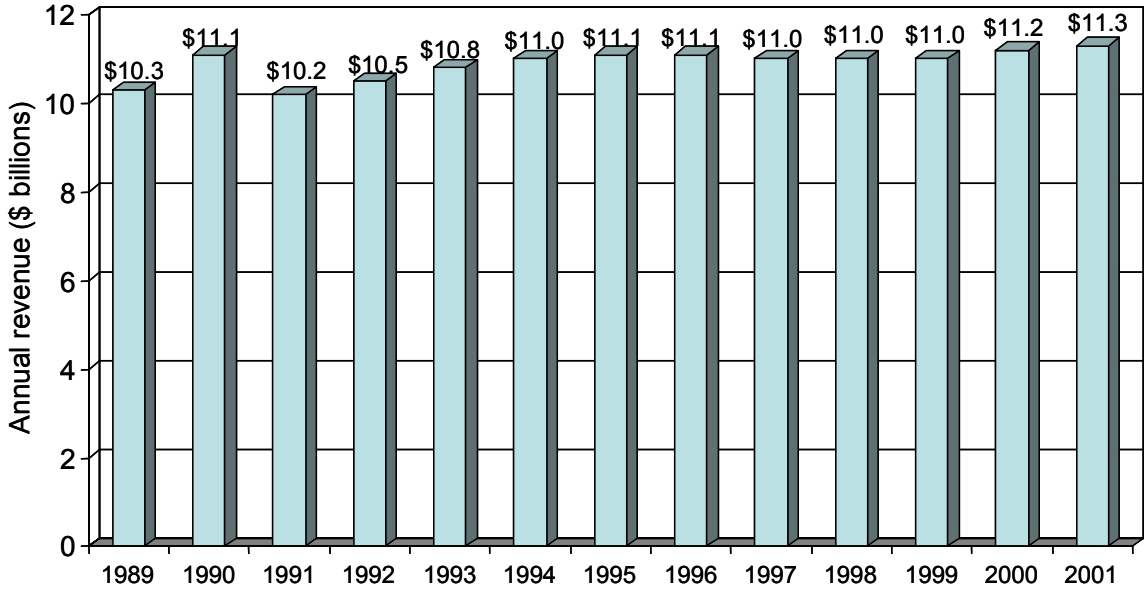
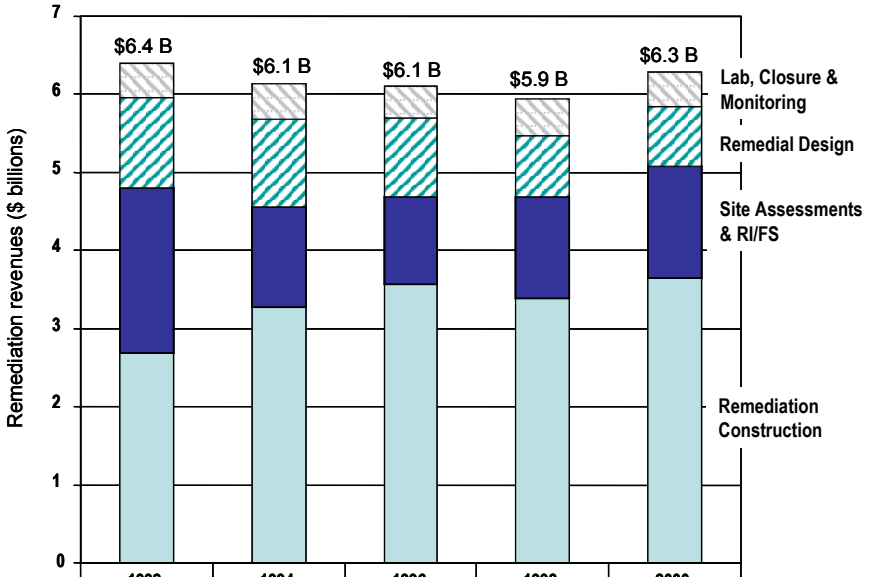


Fig. 3.1. The U.S. environmental remediation/industrial services market is essentially flat. *Source*: *Environmental Business Journal* 11 no.7 (1998); *Environmental Business Journal* 12 nos. 5–6 (1999); *Environmental Business Journal* 13 nos. 3–4 (2001), and EBI, Inc., June 21, 2002.



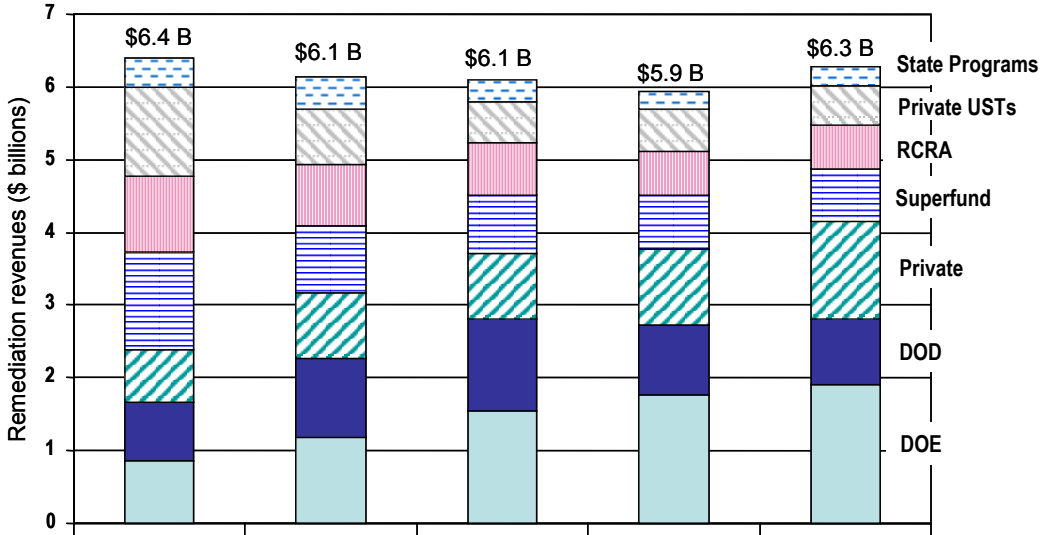
	1992	1994	1996	1998	2000
Lab, Closure & Monitoring	$448 M	$448 M	$401 M	$475 M	$440 M
Remedial Design	$1152 M	$1125 M	$1010 M	$772 M	$754 M
Site Assessments & RI/FS	$2112 M	$1282 M	$1128 M	$1307 M	$1444 M
Remediation Construction	$2688 M	$3275 M	$3561 M	$3386 M	$3642 M

Fig. 3.2. The U.S. environmental remediation market by activity phase. Declines in site assessments and remedial design are offset by growths in remediation construction; overall the remediation market is nearly flat. *Source:* EBI, Inc., May 8, 2002.

1999 and 2% in 2000 to $2.6 billion. Farkas Berkowitz reports the U.S. remediation construction market declined 8% in 1999 and remained flat in 2000 at $3.4 billion. For remediation consulting and engineering, Farkas Berkowitz reports that the market was flat from 1998 to 1999 and declined 7% in 2000 to $3.6 billion.

Trends

While the size of the U.S. remediation market has not changed much over the past several years, the nature of the market and the major players have changed significantly as a result of a combination of consolidation effected through mergers and acquisitions, marketing success, and the procurement trend for large DOE projects. As depicted in Fig. 3.3, which is based on data from EBI, while the overall market grew almost 6% from 1998 to 2000, DOE, state programs, and private remediation [excluding underground storage tanks (USTs)] were the only areas of growth. EBI reports that DOE remediation spending increased 8% from 1998 to 2000, as did state programs (albeit on a much smaller spending base). The Administration's push for accelerated risk reduction and site closures may further boost this market. Private remediation spending (excluding USTs) grew 28% from 1998 to 2000. DoD spending declined 6% over the same time frame (note that its remediation spending base is only half that of DOE). RCRA and Superfund remediation spending decreased 3% over the 1998/2000 timeframe and the private UST market declined by 4%.



	1992	1994	1996	1998	2000
State Programs	$394 M	$425 M	$301 M	$248 M	$269 M
Private USTs	$1231 M	$767 M	$569 M	$568 M	$544 M
RCRA	$1054 M	$853 M	$711 M	$604 M	$596 M
Superfund	$1329 M	$912 M	$811 M	$741 M	$713 M
Private	$729 M	$916 M	$905 M	$1056 M	$1352 M
DOD	$798 M	$1081 M	$1260 M	$963 M	$904 M
DOE	$866 M	$1176 M	$1543 M	$1759 M	$1903 M

Fig. 3.3. U.S. remediation market by funding source. DOE represents one-third of the market. *Source:* EBI, Inc., May 8, 2002.

Consolidation within the remediation construction market continues to be a dominant trend with a few large contractors monopolizing the market in hopes of squeezing more profit from size. Bechtel has the largest share of the remediation construction market by far. In 2000, Bechtel was followed by the IT Group (now part of Shaw Group), Washington Group International, Fluor Corporation, and URS in descending order of revenues (Farkas Berkowitz 2000). Few new entrants have found a way to be sufficiently competitive. The consolidation trend—already pronounced and highlighted in previous editions of this report (YAHSGS 2001)—continued strongly in 2000 and 2001, with Bechtel scoring major wins at DOE sites across the country. This trend is illustrated by data from the DOE sector, presented in Fig. 3.4.

To understand the extent of consolidation, Farkas Berkowitz compared market shares among remediation market competitors in 1994 and 1999. In 1994 the share of the total remediation market claimed by the top ten companies was 38% (Farkas Berkowitz 1999). In 2000 the top five companies claimed 50% of the market (Farkas Berkowitz 2000). Yet despite consolidation, competition remains high, forcing lower prices and greater contractor risk assumption.

The poor financial performance of remediation companies also continues. Cleanup companies have been plagued by numerous bankruptcies, low profits, declining stock prices, loss of key people as financial rewards are cut, and exit of large players with assets. The consolidation of firms and the diversification of firms into other, more profitable markets means that customers like DOE now face a smaller contractor base with less "risk-bearing capacity" (Tomlinson and Paterson 2002).

At $1.9 billion in 2000, DOE continues to provide the largest funding within the U.S. site remediation market; however, as noted by Farkas Berkowitz, "Estimating the size of the remediation market is particularly difficult because of the uncertainty surrounding how to account for revenues generated from DOE's Environmental Management Program" (Farkas Berkowitz 2000). Firms differ in how they

Project	State	End Date	Contractor	Annual Value
West Valley	NY	09/30/01	**Westinghouse;** contract being evaluated	$105
Hanford Env. Rest. (ERMC)	WA	06/30/02	**Bechtel**; **CH2MHill** is a major sub	$120
Mound	OH	02/03/03	**BWXT** and Roy F. Weston lead cleanup	$100
Adv. Mixed Waste Plant	ID	03/31/03	**BNFL** privatization; incineration alternative	$84
Oak Ridge EM (M&I)	TN,KY,OH	09/30/03	**Bechtel-Jacobs** took over for Lockheed	$415
INEEL	ID	09/30/04	**Bechtel (with BWXT)** took over for LM	$455
WIPP	NM	12/31/05	**Westinghouse (WGI)** and Roy F. Weston	$100
Savannah River	SC	09/30/06	**WGI** renewed; Bechtel is a major sub	$1,514
Hanford Tank Mgmt.	WA	09/30/06	**CHG** (CH2MHill) bought from Lockheed	$360
Hanford Site Mgmt. (M&I)	WA	09/30/06	**Fluor** renewed (Duke withdrew)	$570
Hanford Vit Plant Construction	WA	07/31/11	**Bechtel-WGI** won v. **Fluor-FWC**	$339
ETTP	TN	Negotiating	**BNFL** awarded unsolicited offer ($290M)	$0
Weldon Springs	MO	to closing	**Westinghouse** has project to closing	$63
Rocky Flats	CO	to closing	Kaiser-**CH2MHill** extended with changes	$478
Fernald	OH	to closing	Competed, but only **Fluor** bid	$240
			Total for EM Major Contracts ($ millions)	**$4,943**

Fig. 3.4. The consolidation of EM's contractor base continues with few new names being added. Note that DOE contracts specify that much of the contract funding be subcontracted to other firms. *Source:* W. Howes, D. Berg, and A. Paterson, "Analysis of the DOE Contractor Base (v2000)," November 5, 2001.

report DOE-related revenues, introducing some uncertainty into revenue figures.

The EM contractor mix has changed substantially as DOE's focus matured on actual cleanups and site closures. For example, the old school major-manufacturer M&O contractor companies departed in the late 1980s and early 1990s and have been replaced by project-oriented engineering and construction firms such as Bechtel, Fluor, Jacobs, the Washington Group International, and CH2MHill. The old school of remediation companies such as Chem Waste's ENRAC, OHM, and IT have morphed into new companies and, sometimes, morphed again through ongoing consolidation.

DOE EM contracting reached unprecedented levels in 2000 with 13 major contracts let between January 24, 2000, and January 17, 2001. Twelve of the thirteen EM contracts had maximum values that exceeded $1 billion, and Bechtel was awarded 5 of the 13 contracts. DOE contracts specify that much of the contract funding be subcontracted to other firms. As a result, niche subcontractors are part of the remediation teams at every site. However subcontracting is also concentrated among a handful of firms (CH2MHill, BNFL, BWXT, Jacobs) that also serve as prime contractors on some projects. And a few players, including Roy F. Weston and IT Group (now Shaw Group), perform the actual field remediation work throughout the DOE complex. Thus, subcontracting requirements notwithstanding, consolidation remains a major trend in the remediation market.

Currently, the top four contractors share over 50% of EM revenues on a net revenue basis (after subcontractors are paid) as illustrated in Fig. 3.5. And on a gross basis, the top seven EM contractors control roughly 90% of contract revenues. A recent DOE study (DOE 2001) reported that the number of potential bidders for major DOE contracts has diminished from 20 to 30 companies a decade ago to about 10 companies today, with recent procurements for multi-billion dollar site management contracts receiving only one or two proposals (e.g., the Office of River Protection Tank Waste Remediation System, Fernald Environmental Management Project, and Savannah River Site). The reluctance of contractors to bid on major DOE procurements suggests no-bid decisions based upon a combination of low profit margins and futility.

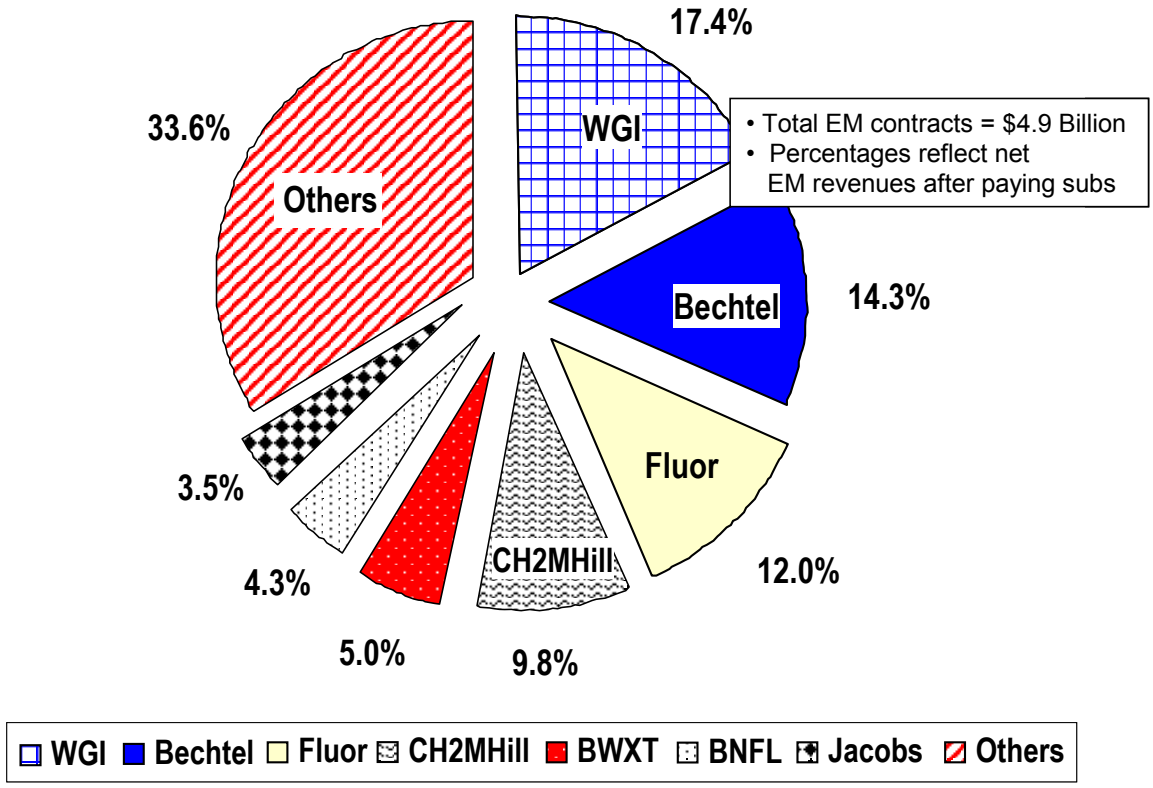


Fig. 3.5. Competition among remediation firms is diminishing. Four contractors receive over 50% of EM remediation revenues after paying subcontractors. *Source:* Tomlinson and Paterson 2002.

DOE is continuing its project orientation and continues to focus on performance-based contracting approaches to increase the value received from its contracts. The use of stretch goals, found to be an important inducement at Rocky Flats, is continuing throughout the DOE complex. The Top-to-Bottom Review commissioned by the Assistant Secretary for Environmental Management in 2001, highlights the need for DOE to strengthen its business practices and to flow performance-based approaches down through the contractor levels (DOE 2002). This is consistent with an overall market trend. In 1994 two-thirds of remediation contracts were based on time and materials (T&M). The T&M percentage has been sliding since that time as remediation revenues flow more to construction and less toward environmental studies. EBI's 2000 survey indicated that 50% of remediation contracts are T&M with 28% lump-sum and 22% unit-priced contracts making up the balance. Consulting companies providing risk-related services (e.g., RBCA) are a factor in T&M revenues maintaining a dominant percentage. EBI forecasts that risk-based services will continue to be a major factor in determining remediation technology applications as well as marketshare over the coming decade (EBI 2001b).

The second largest remediation funding source is the private market and related brownfield areas at $1.4 billion for 2000. The number of private sites being addressed has tripled from 5 years ago as the economy has expanded and risk-based and reuse standards have opened a redevelopment window. In the brownfields market, industrial value, not regulations, drive cleanup. Data for 2001 are not yet available;

however, Farkas Berkowitz anticipates that with the decline in gross domestic product in the latter half of 2001 and continuing economic challenges in 2002, a slowdown in private remediation spending will occur in 2002 and 2003.

The third largest remediation market-sector funding source is DoD; however, at $904 million, DoD's 2000 remediation funding is down 28% from its 1996 high point of $1.26 billion as previously shown in Fig. 3.3. Farkas Berkowitz reports that DoD remediation funding has declined due to adjustments in the base realignment and closure approach, intended to better align appropriations with commitments. Farkas and Berkowitz previously reported DoD remediation funds to be distributed primarily among its existing contractors, with little new contracting opportunity for outsiders (Farkas Berkowitz 2000). Farkas Berkowitz most recently reported that the DoD market exploded in 2001, the most active year since 1997. Major contributors to the growth in 2001 include the Corps of Engineers' TERCs with cumulative contract values from multiple awards exceeding $1 billion, and Air Force remediation services contracts with cumulative contract values from multiple awards of approximately $0.75 billion.

Reductions in remediation spending in the Superfund, RCRA, and private USTs sectors appear to be partially due to modified enforcement, partially due to the use of RBCA standards[9], and partially due to a much greater use of *in-situ* treatment techniques that are less expensive to implement.

While a significant downward trend in the number of technologies deployed per project has occurred over the past several years, use of *in-situ* treatment technologies that can save money on excavation, transportation, and disposal has increased. EBI reported 1.7 technologies used per project in 1992 and only 1.06 technologies used per project in 2000. Bioremediation has continued to hold a strong position for soils remediation. For groundwater, pump and treat systems are still deployed 2.5 times more frequently than *in-situ* approaches; however, the use of biotreatment and air sparging has increased noticeably (EBI 2001b). The EPA status report, *Treatment Technologies for Site Cleanup* (EPA 2000) indicates that treating (as opposed to containing) contaminant sources has risen from 40% in 1997 to 47% in 1999 while containment of contaminants has dropped from 46% to 32% in the same period. More than twice the volume of soil is treated *in-situ* as is treated *ex-situ*, with soil vapor extraction (SVE) being the most widely used technology (26% of all projects reported used SVE) followed by *ex-situ* solidification and stabilization (19%) and off-site incineration (13%). Overall, SVE is the technology deployed for 57% of all soil treatment. This is likely because 80% of Superfund cleanups involve organics and 20% address metals. Fig. 3.6 depicts the breakdown of technologies deployed for Superfund remediation projects over the past two decades and the substantial use of *in-situ* techniques for source treatment.

Outlook

Farkas Berkowitz does not see the decline from 1998 to 2000 as part of a trend, but rather, as part of a normal fluctuation that has existed in the remediation market over the past decade. On the other hand, EBI projects a 33% decline in remediation/industrial services revenues from 2000 to 2010. Disagreement between those two sources is common, normally due to a lack of standardization regarding definitions, analysis method, and data sources.

[9] Cary Perket of Environmental Information Ltd. (EI) predicts that $6 billion in cleanup revenues will be lost to U.S. firms as a result of RBCA (Perket 1998).

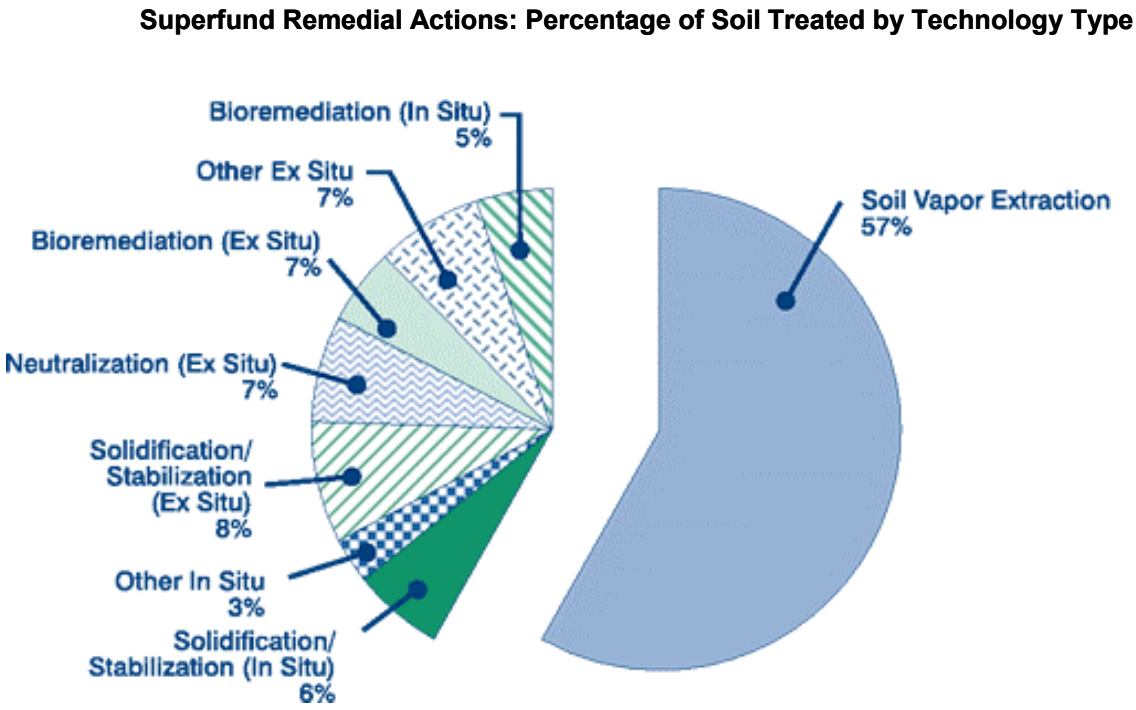


Fig. 3.6. Increasing use of *in-situ* technologies reduces remediation costs. *Source:* EPA 2000.

Elements suggesting decline include increased use of risk-based cleanup standards, decreased Superfund spending, modified enforcement, and a national economic downturn. While EM's Cleanup Reform Account should, in theory, result in higher remediation spending over the coming decade, how much of the EM funding translates into actual remediation work and how much is consumed by management, regulatory, and contractor inefficiencies is yet to be seen. On balance, a flat to slightly negative trend would be anticipated by the authors over the next 3–5 years, with an increasingly negative slope beyond that time.

Remediation is a market that will exist well past the next decade, slowly winding down other than those elements associated with post-closure monitoring and long-term stewardship, which have yet to bloom. Another possible bright spot is the international market, as the market for remediating groundwater and soil in Europe and Africa is anticipated to remain relatively strong.

On the other hand, despite consolidation, sufficient capacity exists to maintain commodity pricing for cleanup activities except in those cases where specialized knowledge can lead to lower project costs e.g., via bioremediation and other *in-situ* technologies. It should also be noted that the Price-Anderson Amendments Act, section 170 of the Atomic Energy Act of 1954, as amended, which provides for payment of liability claims in the event of a nuclear incident at commercial nuclear power plants and DOE facilities, expired on August 1, 2002. Legislation to reauthorize Price-Anderson was being considered by Congress before it recessed In August 2002 and Congress is expected to reauthorize Price-Anderson when they reconvene. In the meantime, contracts awarded or extended before August 1, 2002 continue to be covered until contract expiration. Failure to renew the Act would further deter private-sector participation in nuclear activities.

3.2 Consulting and Engineering

Market Overview

Steady 2000 and 2001 growth in the consulting and engineering segment reflects ongoing demand by government and the regulated community for assessment, design, and cleanup projects. The environmental consulting and engineering industry includes engineering, consulting, design, assessment, permitting, project management, and monitoring services. Clients include industry, government, municipalities, and publicly owned treatment works (POTWs). The $18.0 billion 2001 consulting and engineering segment has continued its steady growth since 1996 with 4% revenue growth from 2000 to 2001, following 5% growth during each of the two previous years. Table 3.1 illustrates the growth in the consulting and engineering market from 1995 through 2000 and provides the breakdown of the market by media, customer, and region.

The majority of the growth in 2000 occurred in the water and wastewater media, and growth was concentrated with state and local government customers. Among customers, the federal sector is growing at the slowest rate. Among media, water/wastewater and multimedia are the fastest-growing sectors, with water and wastewater making up nearly one-third of the consulting and engineering market. Forty-five percent of the 2000 consulting and engineering revenues were associated with hazardous waste and remediation,

Table 3.1. U.S. environmental consulting and engineering market breakdown by media, customer, and region

	1995 ($ Million)	1997 ($ Million)	1999 ($ Million)	2000 ($ Million)
By media				
Hazardous waste	4,440	3,930	3,850	4,040
Remediation	3,730	3,720	3,790	3,840
Wastewater	2,430	2,730	3,070	3,380
Air quality	1,370	1,290	1,150	1,060
Solid waste	1,290	1,050	1,040	1,050
Water	1,080	1,270	1,970	2,200
Natural resources	870	770	910	980
Energy	290	250	290	270
Multimedia	N/A	290	500	590
By customer				
Federal government	5,090	5,300	5,090	5,130
State government	1,090	970	1,030	1,200
Local government	2,500	2,410	2,480	3,030
Private sector	6,830	6,610	7,970	8,050
By region				
United States	14,380	13,640	14,420	15,220
Non-United States	1,120	1,670	2,150	2,190
Total	**15,500**	**15,300**	**16,600**	**17,400**

Source: EBI, Inc.

down from 53% in 1995. When broken down by service line, substantial growth in 2000 was seen in assessments (10%), pollution prevention (8%), operation and maintenance (7%), and design (7%).

EFCG compiles data on the industry based on a survey of firms. EFCG reports that "environmental consulting and engineering has been having its best year in a long, long time," with a median 2001 growth of 10% for the firms surveyed (EBI 2002). For 2000, the survey respondents achieved 11% revenue growth. EFCG's data reveal a clear difference in growth and profitability by customer sector, however. For 2001, growth in the federal sector was 6.5% compared with 10% for state/municipal customers and 10.9% for private-sector work. The operating margins breakdown is similar: 5.7% for federal, 9.4% for state/municipal, and 10.4% for the private sector.

Although the reason for the difference between EBI's and EFCG's data is unclear, part of the explanation may lie in the fact that the relatively well-defined contours of the environmental consulting and engineering industry during the 1980s and early 1990s have faded as firms have diversified outside of their traditional boundaries, and as the work of providing environmentally sound solutions to infrastructure-development and facility-management problems is taken up by a broad range of companies sporting different definitions of themselves. In addition, the EFCG survey tends to be weighted to larger firms which, as indicated in Table 3.2, are experiencing stronger growth than the consulting and engineering market overall.

Trends

The boom in merger and acquisition activity since the mid-1990s continues in the consulting and engineering segment. According to EFCG, the number of firms expecting to complete deals in 2001 was up over 1999 and 2000, along with the number of deals they plan to complete (EBI 2002a). EBI reports that some key drivers of consolidation are still in place. A trend towards the design-build contracting approach tends to favor larger firms. Interest rates are low, rendering deal-making more attractive. And investors that finance management buyouts will require an exit strategy, thereby potentially prompting another round of significant deals. Finally, many companies see a competitive advantage to greater size: URS, Mactec, and many other engineering firms have justified their

Table 3.2. Revenue distribution of 2000 U.S. consulting and engineering market

	No. of firms	Total Revenues ($ millions)	Market (%)	Growth in 2000 (%)
Large > $100 M	27	9,626	58%	8.5%
Mid $20–100 M	86	4,368	26%	6.9%
Small $10–20 M	83	1,183	7.1%	0.3%
Small $5–10 M	124	799	4.8%	-4.9%
Small $1–5 M	360	710	4.3%	-9.3%
Small <$1 M	2,920	724	4.4%	-10.3%
Total	3,600	17,410		5.1%

Source: EBI, Inc.

acquisition strategies in part to achieve the "critical mass" needed to compete for larger projects, such as DOE and DoD cleanups, or to win national accounts with Fortune 500 firms.

According to Steve Maxwell, most of the consolidation is driven by one of two factors. First, consolidation provides the ability to buy revenues, profits, and customers at a price below what it might cost to develop them organically. Second, consolidation is an attempt to quickly and more cheaply diversify into an end market or geographic region that is deemed to be strategically desirable (Maxwell 2000).

Of course, consolidators face many pitfalls and several past acquirers have faced trouble. The most recent example is the IT Group. The IT Group set perhaps the most aggressive pace of acquisition in the environmental consulting and engineering segment; with backing from the Carlyle Group, IT Group dramatically increased its size through the acquisition of 10 companies over a three-year period beginning in 1997. The resulting debt burden proved too much, and the IT Group reached an agreement in January 2002 to sell its assets to the Shaw Group.

According to Alan Farkas, the anticipated economies of scale have been elusive, and Steve Maxwell reports that there is no evidence that size necessarily conveys advantage in terms of profitability. Nevertheless, several consulting and engineering firms are making consolidation work, including Earth Tech, Mactec, Tetra Tech, and others. As illustrated in Table 3.2, 0.8% of U.S. consulting and engineering firms generate 55% of revenues. Consolidation is projected to continue, with the bigger firms getting still bigger.

Diversification, another strategy for dealing with the changes occurring in the industry, has had success with some companies, and, in part, the growth in the consulting and engineering segment is due to the broadening and diversification of services offered by these firms. The consulting and engineering segment has the greatest potential within the environmental industry for success in diversification because of the wide range of applicability of the typical consultant/engineer's basic skills. Many firms are working to broaden their identity from environmental problem solvers to business solution providers and are positioning themselves as more integrated professional services providers. Services such as outsourcing, information management, property portfolio management, and operations and maintenance are all increasing as a logical extension of core competencies. Environmental consulting and engineering firms are also diversifying into nonenvironmental markets such as transportation and telecommunications. Diversification allows a company to distribute its risks and remain stable when specific sectors soften. For example, with the end in sight for the DOE's EM program, firms focused on that market are looking to diversify into other service areas.

The emergence of risk-based standards for site cleanup and redevelopment has led to an increase in assessment work. Risk assessment is increasing in the private sector because of its ability to help clients address site problems at lower cost. This trend is increasing the consulting business as it reduces the cost of remediation.

Principal concerns identified in EFCG's survey of industry executives are staffing and recruiting, economic slowdown, and the risks of fixed price and design/build contracts. These issues are general trends throughout the industry and are discussed further in Section 2.

Outlook

The absence of regulatory drivers and the weak economy lead to projections of declines in this segment. In years past, the lack of regulatory drivers has been offset by economic prosperity,

which produced more work for all types of consulting and engineering firms. Paul Zofnass of EFCG states that he "wouldn't be surprised if there is a significant softening over the next few years. As the economy softens, our industry will, but there is a lag effect. The pendulum tends to swing more slowly in the public sector than the private sector. Those firms with more work with government clients may find that they are affected by the recession later rather than sooner." EBI projects that the consulting and engineering segment will decline 13% over the decade 2000–2010, as illustrated in Fig. 3.7.

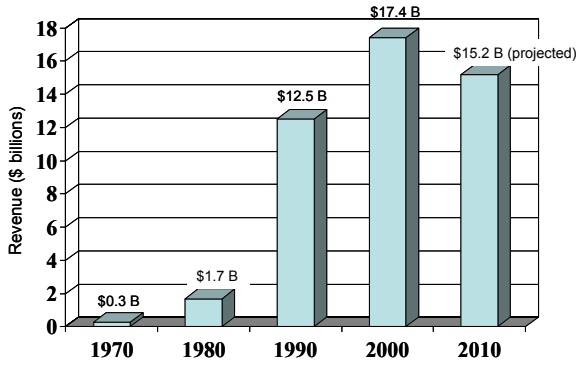


Fig. 3.7. Revenue growth and projected decline in the U.S. consulting and engineering industry. *Source:* EBI, Inc.

As with the remainder of the industry, gross figures disguise important differences within the segment. When viewed by media, energy is projected to have the best outlook in the near term, while the water/wastewater sector continues to be viewed as a growth opportunity over the longer term. By service, information management is projected to be the largest growth area.

3.3 Hazardous Waste Management

Market Overview

While the hazardous waste market has become more concentrated through consolidation and facility closures, the volume of hazardous waste handled off-site at commercial facilities has changed little in recent years. The remaining facilities still have more than adequate capacity to handle the volume, and the industry remains highly competitive.

The hazardous waste management segment includes management of industrial hazardous waste, medical waste, and nuclear waste, with industrial hazardous waste representing the largest component of this segment. Typical clients include chemical and petroleum companies and government agencies.

Hazardous waste management has had a violent past of rapid growth followed by decline, as illustrated in Fig. 3.8. According to Farkas Berkowitz, the hazardous waste industry was born in May 1980 with the promulgation of the first set of enforceable federal regulations under RCRA. Firms present at the birth of the new industry were well rewarded, at least initially. Then, the prospect of high growth and profitability, combined with relatively low barriers to entry, led to a buildup of capacity that greatly exceeded demand. By 1990, the industry growth rate began a sharp decline. Beginning in 1993, industry revenues declined on an absolute basis and have been declining ever since.

The hazardous waste management segment continues its steady fall, from $5.7 billion in 1998, to $5.3 billion in 1999, $5.1 billion in 2000, and $4.9 billion in 2001. Including hazardous waste revenues generated in the analytical services, consulting and engineering, instruments and information systems, waste management equipment, and resource recovery industry segments, the total industry revenue

attributed to hazardous waste management in 2001 is $12.8 billion or 6% of the $213.1 billion total environmental industry revenue.

Farkas Berkowitz focuses on the industrial hazardous waste management component of the segment ($3.3 billion in 2000) and estimates that this sector began to stabilize in 1998 as volumes held steady and prices plateaued. They estimate that industry revenues increased about 9% from 1998 to 2000. But while demand is currently stable, it is not growing. They argue that given the 2001/2002 recession, demand will fall because it correlates with production volume. The industry is also fiercely competitive and capital intensive. Both factors put pressure on pricing. Finally, high barriers to exit result in a slow pace of capacity reduction to bring it more into line with demand.

Farkas Berkowitz reports a median operating margin of 3.7% in 2000 among industrial hazardous waste firms, an improvement over the median operating margin of 1.0% in 1999, and a reflection of modest price increases. According to EI President Cary Perket, the median of public hazardous waste companies tracked by EI posted net losses each year from 1995 through 2000, due to very low income from operations with significant debt. This reflects the fact that pricing is still not at a sustainable level for many firms, placing many companies in dire straits financially. The pricing problem is due to overcapacity and intense competition in many sectors of the industry. Thus while waste volumes may have stabilized, concerns about overcapacity and low investor interest continue to plague the industry.

Major services include incineration, cement kiln, land disposal, and aqueous treatment. For incineration services, supply and demand are coming into balance, aided by Safety-Kleen's idling of incinerators. While the number of incinerators has declined, the volume of waste burned annually in commercial incinerators in

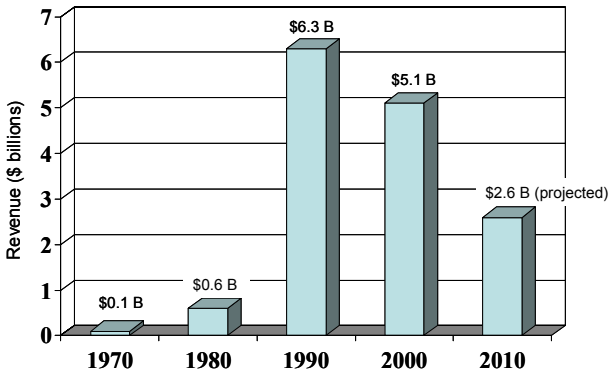


Fig. 3.8. The rise and fall of the hazardous waste management industry. *Source:* EBI, Inc.

the U.S. has been fairly steady for the past 5 years. EBI reports that capacity has declined four years in a row, but the market has still yet to reach equilibrium to support price improvement. EPA's new MACT standards are projected to result in the closure of as many as 30% of 122 applicable incinerators from 1996 to 2005. The number of cement kilns burning hazardous waste as fuel has dropped from 26 in 1995 to 16 in 2001. As is the case with incineration, while the number of cement kilns burning hazardous waste as supplemental fuel has decreased, the volume of wastes burned in cement kilns has been approximately constant for the past 5 years.

Quantities of waste going to hazardous waste landfills in the U.S. have averaged around four million tons, with the projected decline in polychlorinated biphenyl (PCB) and remediation waste disposal markets being slower to materialize than expected. Volumes of manufacturing processing wastes are strongly dependent on the state of the manufacturing economy: they declined in the 1990–1991 recession, and Farkas Berkowitz projects that they are likely to decline in the 2001–2002 recession. Hazardous waste landfill prices were approximately the same in 2000 as in 1999.

Aqueous waste treatment is another large component of this segment. Over 90% of the wastes regulated as hazardous are aqueous wastes, and over 90% of those are treated at the site of generation. As a result, aqueous waste treatment is mainly a local market. Farkas Berkowitz reports that the aqueous waste treatment market is intensely competitive. Prices have stabilized, but supply still exceeds demand and margins are thin.

Trends

Consolidation and diversification remain important trends in this segment as companies respond to stiff competition and inadequate pricing. As a result of consolidation activities, the industrial hazardous waste management market had fewer than two hundred firms remaining in 2000. Safety-Kleen retained its leadership position, with a 27% market share. Six firms, each with annual revenues of $200–$400 million account for 40% of the market: Onyx Environmental Services, Philip Services, Clean Harbors, Rhodia, Heritage Environmental, and Waste Management, Inc. Onyx Environmental is a wholly owned subsidiary of the French Vivendi and is made up mainly of the facilities and businesses that were formerly part of Chemical Waste Management. The French Onyx is the number two firm in North America with annual revenues of about $350 million, but its worldwide hazardous waste revenues are in the billions of dollars. Eleven firms, each with annual revenues of $30–$100 million, collectively represent 18% market share in 2000. Of these, two provide radioactive waste management services as well as hazardous waste services: Perma-Fix and American Ecology (Farkas Berkowitz 2001).

However, consolidation is not without pitfalls. Laidlaw Enviromental Services (LES), now operating as Safety-Kleen, was the best known and most active consolidator. Over the period 1993 to 1996, LES grew at an average compound annual rate of 12%, mainly by acquisition. Safety-Kleen filed for Chapter 11 protection in June 2000, and in June 2002, the U.S. Bankruptcy Court approved the sale of Safety-Kleen's Chemical Services Division to Clean Harbors Inc. The transaction will make Clean Harbors the largest operator of hazardous waste facilities in North America, with approximately $750 million in annual revenues, 4,400 employees, and 38,000 customers.

Perma-Fix Environmental Services made two acquisitions in 2000 to expand its position in the treatment of low-level radioactive waste and mixed waste, acquiring Diversified Scientific Services Inc. and East Tennessee Materials and Energy Corporation.

Diversification also continues, as firms that manage hazardous wastes regulated under RCRA and the Toxic Substance Control Act (TSCA) at commercial facilities are diversifying into, for example, providing services for managing processing wastes, both hazardous and nonhazardous, at the site of generation. Firms in the hazardous waste industry are also providing new services including outsourcing, waste minimization, waste recycling, and other types of industrial services at customers' plants.

Nuclear waste management is anticipated to be a flat or declining business. Increases in waste volumes brought about by decontaminating and decommissioning the nation's commercial nuclear reactors have been offset by highly competitive pricing spurred by the ability to cheaply dispose of some nuclear waste in Tennessee landfills. Tennessee is the only state to have below-regulatory-concern regulations that provide for unregulated disposal of very-low-activity wastes. Moreover, decontaminating and decommissioning has been slower than initially projected because of a trend towards the consolidation of the ownership of existing nuclear plants by a few large nuclear utilities who have a greater capability to file for life extensions. Nuclear waste volume reduction has

also fallen on harder times leading to the bankruptcy of ATG and site closings and layoffs by Duratek.

Waste minimization, risk-based cleanup standards, modified enforcement, and a slowdown in remediation work are other important trends influencing the hazardous waste segment. Finally, a major unresolved issue for the industry is the substantial costs associated with facility closure and post-closure care, which are compounding the industry's overcapacity problems (EBI 2002c).

Outlook

EBI concludes that waste minimization, risk-based cleanup standards, modified enforcement, and competitive pricing mean difficult times ahead for the hazardous waste industry. The hazardous waste management segment is anticipated to remain in decline until it self-corrects its overcapacity problems through attrition and/or consolidation, since overall waste volumes are projected to be flat or decline due to constant or declining projected waste volumes generated from site remediation activities. Farkas Berkowitz concludes that while the industry will never return to the high growth rates of the 1980s, it will never waste away either because it provides an essential public service. However, the industry structure is undergoing major changes in terms of competitors, types of wastes handled, and types of services offered. EBI projects that the relentless decline that began in 1993 will continue: the 19% decline in the 1990s is projected to be followed by a 49% decline from 2000 to 2010.

3.4 Analytical Services

Market Overview

The environmental testing business is now experiencing stabilization resulting from consolidation and capacity reduction, following a shakeout and decline in the early 1990s. The analytical services industry provides testing of environmental samples (soil, water, air, and some biological tissues) for clients including industry, government, and hazardous waste and remediation contractors. At $1.3 billion, analytical services ties with process and prevention technology as the smallest of the industry segments.

The $1.3 billion environmental testing business has stabilized and even grown since 1998 although it is still down from its 1991 peak of $1.6 billion. The segment saw 1% increase in revenues in 2001, following 8% growth in 2000 and 4% growth in 1999. For now, economic conditions in the environmental laboratory industry are showing improvement, and the business seems to be on a relatively stable course.

Trends

According to Steve Maxwell, substantial capacity has left the industry, and the bankruptcies and financial failures which plagued the industry in years past have faded, the previously dire financial pressures on most firms have subsided, and current players report generally improved market circumstances (Maxwell 2001). Maxwell identifies key trends and technological developments that characterize the environmental testing industry:

- Consolidation has been and continues to be a leading trend in this industry. The merger and acquisition activities of Severn Trent Laboratories Inc. has elevated it to the top position in this segment, four times the size of its nearest competitor. However, the industry is still relatively fragmented and consolidation is projected to continue, particularly at the smaller regional and local level.

- Average productivity in the industry has grown tremendously, with an individual employee producing about three times more analytical data today than a decade ago, and productivity is expected to continue to improve.

- Much of the productivity increase is due to technological enhancements, including robotics and sample preparation technologies for the fixed-base laboratory, as well as field sampling and monitoring technologies.

- The Internet and the improvements it affords for data management has also changed the environmental laboratory industry. Firms are increasingly allowing their clients to access data over the Internet, often even as it is still being processed in the laboratory.

- Personnel issues continue to be important as companies compete to attract and retain employees. These issues are particularly acute for environmental laboratories because they compete for personnel with the medical, pharmaceutical, and biotech industries, where chemists often command higher salaries.

- Certain market niches are strengthening as a result of large-scale exit of capacity over the past years, for example, the radioactive and mixed waste analysis sector is experiencing tight capacity.

EBI notes that the relative stability in the laboratory market has in turn led to improved markets for their suppliers in the instruments and information systems and waste management equipment businesses, as deferred expenditures resulting from uncertain ownership had been a main cause of years of tight markets in those two equipment segments.

Outlook

With the loss of substantial capacity in the industry, the supply/demand imbalance that plagued the analytical services market for years appears to have ended, yet the outlook for this market is uncertain. EBI forecasts more than a 30% decline in analytical services revenues from 2000 to 2010 (Fig. 3.9), whereas Steve Maxwell believes that the worst of the environmental laboratory industry's economic recession has passed (Maxwell 2001). Maxwell projects that the environmental testing business will experience continuing improvement in general economic conditions, improvement in the volume of demand for analytical testing, and improvement in terms of pricing levels.

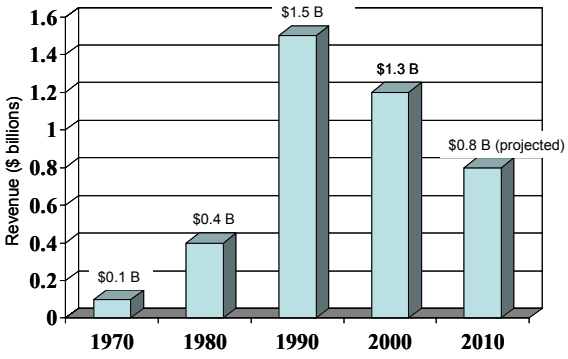


Fig. 3.9. Revenue growth and decline in the U.S. analytical services market. *Source:* EBI, Inc.

3.5 Solid Waste Management and Recycling

Market Overview

The solid waste management industry continues its steady if unremarkable growth, while recycling suffered in the slumping 2001 economy following strong growth in 2000 with the strong 2000 economy. The solid waste management business is relatively resistant to fluctuations in the economy and continues to grow steadily as a function of population and

GNP growth. By contrast, the recent slump in the U.S. economy has had a strong effect on the resource recovery industry. Resource recovery is struggling through tough times caused by leveling off of community recycling rates and the fluctuations in commodity prices in response to a wide range of economic variables including virgin material costs, energy prices, and international economic conditions (EBI 2002b).

The solid waste management industry provides collection, processing, and disposal of solid waste for municipalities and all industries. The resource recovery industry sells materials recovered and converted from industrial by-products or post-consumer waste. Clients include municipalities, generating industries, and solid waste companies.

The U.S. solid waste management business, which represents the largest segment within the U.S. environmental industry, grew 4% to $40.8 billion in 2001, following 6% growth in 2000 (Fig. 3.10). Revenues associated with solid waste management generated by the analytical services, consulting and engineering, instruments and information systems, waste management equipment, and resource recovery segments bring the total U.S. revenues associated with solid waste management to $61.7 billion, or 29% of the $213.1 billion environmental industry total.

While collection is the largest subsegment of the market, landfill disposal is the more profitable subsegment. Operating margins can be as high as 40% for landfills and typically range from 10–15% for collection. The landfill subsegment is also more capital intensive. The collection subsegment is highly fragmented, including thousands of small haulers that transport wastes to landfills or other points of waste consolidation, which are owned and operated by others. The landfill subsegment is more consolidated, with the number of solid waste landfills declining from over 20,000 in 1970 to fewer than 3,800 in 2000. Ownership and operation is shifting towards the private sector, with the private sector owning 34% of operating solid waste landfills in 2000, and processing 70% of the solid wastes going to landfills (Farkas Berkowitz 2001).

The collection and landfill disposal market subsegments are made up of publicly traded companies (seven companies representing 58% of collection and landfill revenues), private companies (23% of revenues), and municipalities (19%). Three companies—Waste Management, Inc. (WMI), Allied Waste, and Republic Services—account for almost one-half of the industry.

The resource recovery business suffered in 2001 from flat volumes and price collapses in steel and paper leading to an overall 14% decline in revenues to $13.7 billion in 2001, following 18% growth in 2000 and 2% growth in 1999. As indicated in Fig. 3.11, the resource recovery market is volatile, fluctuating with commodity prices for recyclable materials. Although numerous materials are included in resource recovery, revenue generation is essentially a factor of spot market prices for metals. Scrap metal prices fluctuate widely with commodities prices. In general, the market will increase when Asian economies are strong because of large metal exports for automobiles. To a lesser extent, recycled packaging material markets also become stronger with the world economy due to larger shipments. On the other hand, when steel imports flood the United States, prices drop, domestic production slows, the demand for scrap decreases, and revenues drop. The same is true for other metals, such as aluminum.

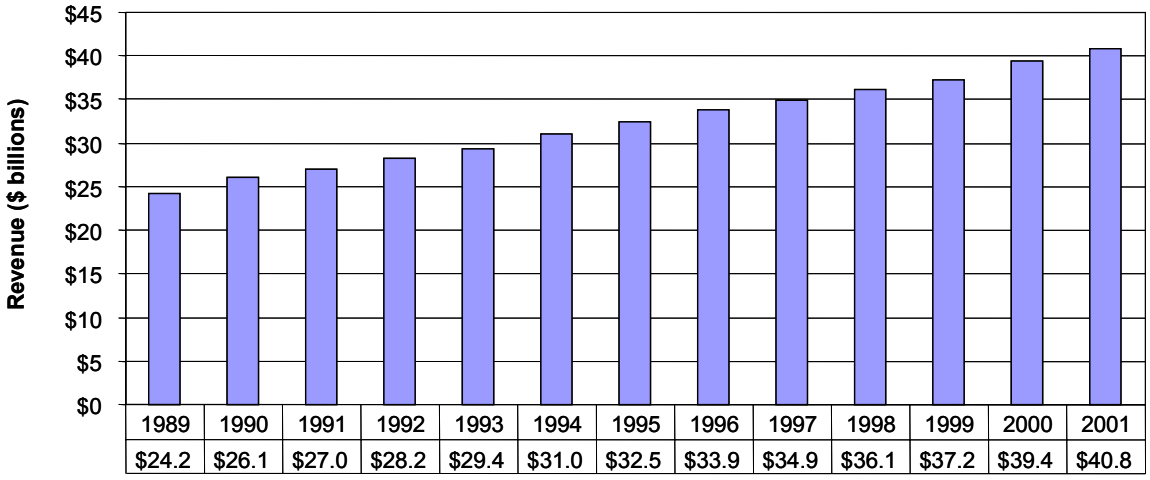


Fig. 3.10. The U.S. solid waste management market continues its steady growth. *Sources: Environmental Business Journal* 11 no.7 (1998); 12 nos.5–6 (1999); and 13 nos. 3–4 (2001); and EBI, Inc., June 21, 2002.

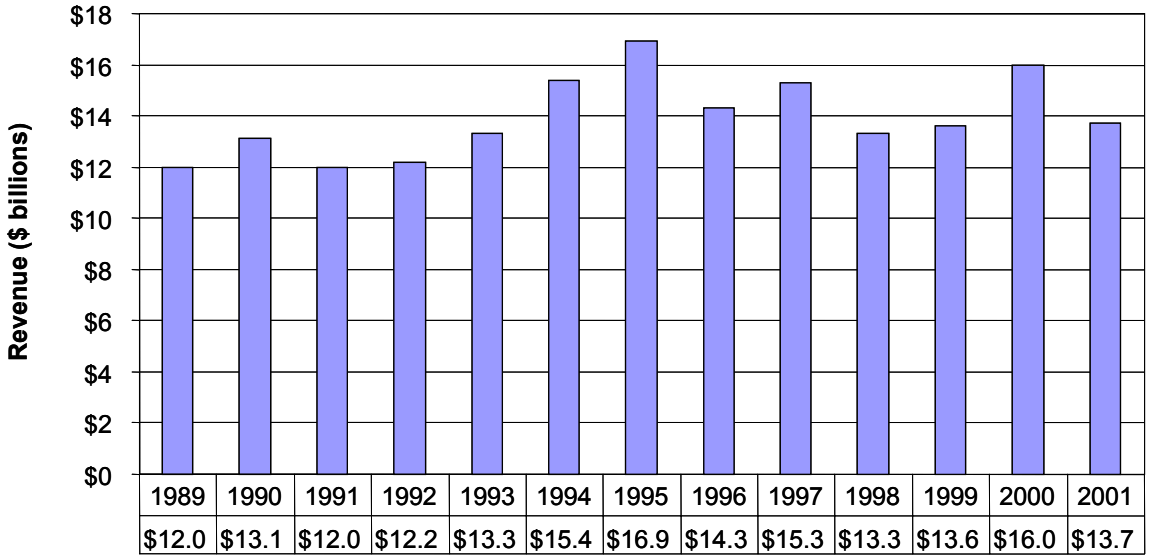


Fig. 3.11. Volatility characterizes the U.S. resource recovery market. *Source: Environmental Business Journal* 11, no.7 (1998), 12 nos. 5–6 (1999), 13 nos. 3–4 (2001); and EBI, Inc., June 21, 2002.

Roughly 25–30% (depending on the data source) of solid waste is diverted to recycling, and 6–10% is diverted to waste-to-energy facilities, with both business sectors being currently flat. Recycling has reached a plateau over the past several years because on the collection side, the low-hanging fruit is gone and the collection costs of each incremental ton are more expensive, and because of the volatility in commodity prices.

Trends

Organic growth of the solid waste market as a whole is on the order of 3–4% annually, with population growth accounting for 1–2% and general inflation accounting for the remainder. Individual companies have traditionally achieved growth rates in excess of the market as a whole by acquisition of private hauling and disposal operations and privatization of municipally controlled solid waste operations. However, the pool of acquisition candidates is shrinking and municipalities have become more reluctant to privatize their solid waste operations. Moreover, given that most of the privately held firms that are potentially available for acquisition are small, meaningful growth by acquisition that would have a significant impact on stock price is not feasible for the larger publicly traded firms (Farkas Berkowitz 2001).

The consolidation of the solid waste management industry is slowing, as the three largest solid waste firms – Waste Management Inc. ($12.5 billion), Allied Waste Industries Inc. ($5.7 billion), and Republic Services Inc. ($2.1 billion) – have changed their strategy from one that emphasizes acquisition to one that emphasizes cash flow (Farkas Berkowitz 2001). As a result of years of acquisitions, those three firms today represent about half of the U.S. solid waste management industry. Yet despite the consolidation that has occurred in the industry, Farkas Berkowitz reports that the industry remains highly competitive.

The two large players in solid waste management, Waste Management and Allied Waste, have reorganized or sold operations to correct financial problems arising from their numerous acquisitions in the late 1990s. In a preview of things to come, the Securities and Exchange Commission recently sued several former executives of Waste Management for accounting improprieties, alleging that they defrauded shareholders through much of the 1990s. The fallout from Waste Management's accounting improprieties lingers on in the industry.

EBI reports that over the long term, a big trend in the solid waste industry is the implementation of bioreactor techniques at landfills to accelerate waste decomposition and thereby both extend the useful lifetime of the landfill and mitigate the facility's harmful impacts on the environment. The adoption of bioreactor techniques would mark a significant departure from existing standards which require the use of liners and caps that "dry-tomb" the wastes and keep them and their hazardous constituents in place for decades, if not centuries. Currently about 20 bioreactor projects are at various stages of development in North America (EBI 2002b).

Technological advance is not a big factor in the waste collection practice, although haulers are relying on increased automation to reduce physical waste handling and thereby improve safety. Haulers are also working to integrate the pickup of solid waste, compostable yard waste, and recyclable materials into a more streamlined operation (EBI 2002b).

In recycling, the big long-term trend is toward "product stewardship." Under product stewardship, makers of carpets, paints, electronic products, and other items would take responsibility for their products at the end of their useful life, taking them back from the consumer and processing the components to create new products. Important initial progress

has already occurred in the areas of carpet and electronic recovery and recycling. In January 2002, representatives of federal and state agencies, carpet makers, and recycling organizations signed a memorandum of understanding to divert 40% of post-consumer carpet wastes from landfills by 2012. In addition, in March 2002, the National Electronics Products Stewardship Initiative, a coalition of government agencies, product manufacturers, and recycling and environmental organizations, agreed to develop a front-end financing system for the collection and reuse of electronic products.

Waste-to-energy is currently a flat business, and no new waste-to-energy plants are under construction in the U.S. due to continued public activist group opposition to incineration. Nonetheless, existing plants that have operated profitably will continue to play a role in a deregulated electricity generation industry, and Farkas Berkowitz views recovery of methane from landfills and animal feedlots for conversion to electricity as emerging growth markets.

Outlook

The solid waste industry is a mature market, with the three multibillion-dollar firms–Waste Management, Allied, and Republic–focusing on slow and predictable growth in net earnings, cash flow, and improved balance sheets rather than further acquisitions. The current economic recession is expected to have little impact on the residential segments of the industry, but the commercial and industrial segments are expected to decline. Overall, EBI projects 20% growth in solid waste management over the decade 2000–2010.

Market volatility and supply/demand fluctuations will continue to make recyclables unpredictable. EBI notes that absent innovation in full-cost accounting for virgin materials or substantial progress in take-back or supply-chain programs, prices and demand for secondary materials will continue to be volatile. Farkas Berkowitz comments that the demand for both virgin and recycled raw materials will continue to decline as long as the manufacturing economy remains depressed. EBI is predicting growth of 28% over the decade 2000 to 2010.

3.6 Environmental Equipment

Market Overview

The environmental equipment industry consists of four EBI market segments[10]:

- Air pollution control equipment. The air pollution control equipment industry produces equipment and technology to control air pollution (including vehicle controls) for clients including utilities, waste-to-energy industries, and the auto industry. The $18.3 billion air pollution control equipment segment showed 4% growth in 2001, following 3% growth in 2000 and 4% growth in 1999.

- Waste management equipment. The waste management equipment industry provides equipment for handling, storing, or transporting waste, including recycling and remediation equipment. Clients include municipalities, generating industries, and solid waste companies. Waste management equipment ($9.7 billion) showed a 1% decline in 2001 revenues, following 4% growth in both 2000 and 1999.

- Instruments and information systems. The instruments and information systems industry produces instrumentation for environmental analysis, information systems, and software for clients including analytical services firms and government-regulated companies. Instruments and information systems ($3.8 billion) showed

[10] Water equipment is addressed as part of the water industry, discussed in Section 3.8.

4% growth in 2001, following growth of 6% and 4% in the two previous years.

- Process and prevention technology. Process and prevention technology includes equipment and technology serving all industries for in-process (not end-of-pipe) pollution prevention and waste treatment and recovery. Revenues in 2001 were $1.3 billion representing 9% growth, following 12% growth in 2000 and 8% growth in 1999.

Together, these four segments account for 2001 revenues of $33.1 billion, an increase of 2.5% over 2000. The fastest growth (9%) was in process and prevention technology. Although this is the smallest market segment, at $1.3 billion, this designation is not likely to continue long: process and prevention technology has more than tripled from its 1990 size of $0.4 billion, and healthy growth in this segment is projected to continue.

Sales of air pollution control equipment by U.S. companies are dominated by mobile emissions control devices. Mobile markets are tied closely to automotive markets; vehicle manufacturers buy catalytic converters and related technologies. The remainder of this segment is the $3.8 billion U.S. market for stationary-source air-pollution control equipment. Major customers include electric utilities; incinerators and waste-to-energy processors; various manufacturing sectors such as pulp and paper, plastic, mining, and metal finishing; cement; chemicals; pharmaceuticals; petroleum refining; printing; and electronics.

About 60% of waste management equipment sales is devoted to solid waste and recycling. The remainder consists of drums, tanks, and other storage units for hazardous, nuclear, and medical waste, as well as incinerators, protective gear, and other equipment related to hazardous waste and remediation. Overall, the hazardous waste equipment subsegments have been flat or declining since the early 1990s because of decreases in volumes of waste generated and number of facilities requiring new capital equipment and the relatively poor financial condition of contractors in hazardous waste and remediation.

The relative stability of the analytical services segment following some shaky years for leading companies has in turn led to improved markets for their instrumentation suppliers as deferred expenditures resulting from uncertain ownership have now been made, improving the equipment market. Environmental management information systems constitute the other part of the instruments and information systems market segment.

The process and prevention technology segment (also sometimes referred to as pollution prevention) works at reducing pollution at its source and includes equipment or processes designed to achieve waste minimization and resource efficiency rather than end-of-pipe control. The focus is on technologies that improve the environmental and economic efficiency of a manufacturing process, whether through more efficient use of material and energy resources, redesign of processes, recycling, novel uses of chemistry, or material and process substitutions.

Trends

The trend in the air quality equipment market is to focus on the electric power industry, because electric utilities have invested substantially in air quality strategies and emissions control equipment in recent years, with the promise of more to come. However, air pollution control companies face major challenges including substantial competition and customers buying on the basis of cost. Many customers are motivated to buy air quality equipment only because they are required to install it, so they are buying just enough, just in time because of pervasive uncertainty as to the nature of future clean air

rules and their enforceability. The latter is particularly important because air-pollution control is a regulation-driven business (EBI 2002c).

In the waste management equipment segment, prices for nonvehicle waste management equipment started growing in early 1999 following 2 years of decline. Prices and demand had been depressed because of low commodity prices and poor performance in the resource-recovery segment as well as because of "preconsolidation" effects at the major solid waste companies. The mergers and acquisitions that have been prevalent in the solid waste management segment also have an impact on the equipment market (1) because of equipment purchase delays by companies involved in mergers and acquisitions activity and (2) as a consequence of having fewer landfills. The solid waste business went into an almost 2-year slump as companies positioned themselves to be sold, and buyers refrained from spending on equipment. In 1999 and 2000, the equipment market recovered because of the release of pent-up demand from the intentional delay of capital expenditures by the major waste companies. Also fueling the growth were the strong economy and the increase in construction starts (EBI 1999). However, in 2001, the waste management equipment business suffered the pains of economic cycles because the ever-constant need to collect and dispose of solid waste does not translate to equipment purchases on a steady basis. Cash-flow problems attributed to the current recession have meant that solid waste firms are not making capital expenditures. Virtually all waste equipment sectors have declined in 2001. EBI reports that margins have always been tight for waste equipment manufacturers, and they are going to get tighter. As the large waste management companies became larger through the consolidations of the 1990s, they have gained purchasing leverage and have been able to command price concessions (EBI 2002b).

Waste management companies are placing an increased emphasis on the automation of their equipment, and automation is growing as both municipal and private buyers try to contain costs and improve efficiency. In addition, EBI suggests that high-tech innovations, such as computer-aided weighing and vehicles equipped with global positioning systems, may be the best way to gain entry to this relatively stable industry (EBI 2002b).

The instruments and information systems segment is being changed by two trends in the analytical services market: the shift away from in-laboratory testing toward field analysis and the increasing use of the Internet for data management (EBI 1999).

An ongoing shift from regulation to market factors as the primary means of achieving environmental improvements is anticipated to bring a shift in focus from cleanup and pollution control to process and prevention. Many analysts believe that factors emerging from the economy itself are becoming increasingly important drivers of the environmental industry; these include cost escalation in raw materials and waste disposal, cleanups based on the economic value of land, economic return for waste minimization, and increased profits and better comparative advantage from increased efficiency. This trend is expected to provide new and expanded markets for the process and prevention technology segment (DOC 2000).

Outlook

As shown in Fig. 3.12, EBI forecasts continued strong growth in process and prevention technology, moderate growth in waste management equipment, an essentially flat environmental instruments and information systems industry, and shrinking air pollution control equipment revenues.

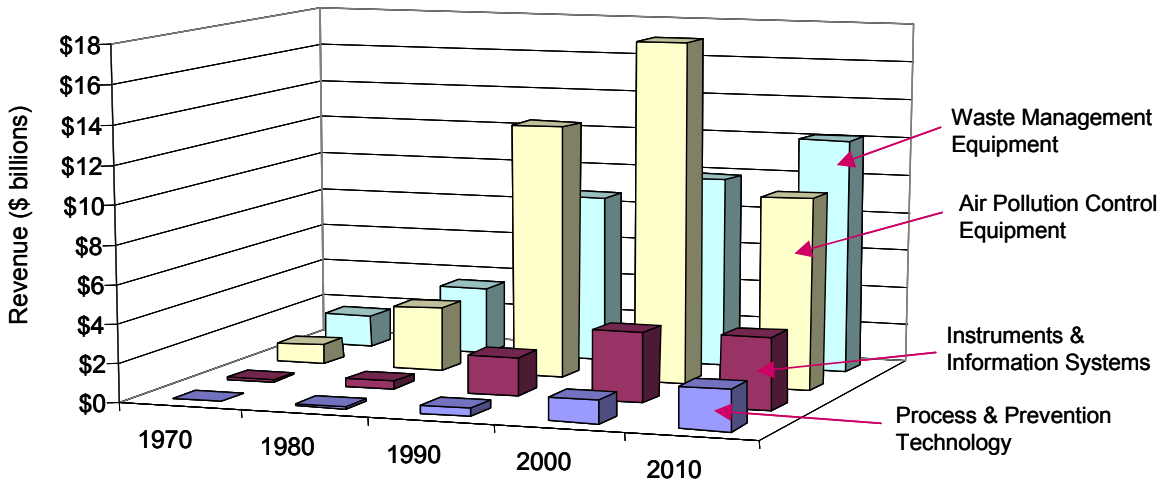


Fig. 3.12. Historical and projected growth in U.S. process and prevention technology, instruments and information systems, waste management equipment, and air pollution control equipment markets. *Source:* EBI, Inc.

The air pollution control equipment market faces considerable uncertainty today, as electric power plants face major questions regarding future clean air rules, climate change, generating capacity security, and electric utility deregulation. Despite a number of drivers, such as New Source Review enforcement, NO_x control initiatives, and EPA's regional haze rule, the schedules for issuing expected new standards are far from certain, and the levels of emissions that are likely to be allowed, as well as the extent to which existing and new standards will be enforced, remain unclear. As long as the specific levels of pollution reduction in any future regulatory initiatives remain uncertain, the air-pollution control market can only wait. The resolution of outstanding regulatory issues will determine the outlook for this market segment (EBI 2002b).

3.7 Clean Energy Systems and Power

Market Overview

Clean energy continued in its position as the fastest-growing environmental industry segment, fueled by strong gains in fuel cells and the solar and wind energy businesses. Solar, wind, and fuel cells each posted revenue growth in excess of 30% in 2001, with fuel cell promising even higher growth rates in the next five years (EBI 2001c).

The clean energy systems and power industry sells power and systems in solar, wind, fuel cells, geothermal, biomass, landfill gas, small scale hydropower, energy efficiency, and demand side management. Clients include utilities, all industries, and consumers. Clean energy systems and power grew 16% in 2001 to reach $10.0 billion, up from $8.6 billion in 2000, as illustrated in Fig. 3.13.

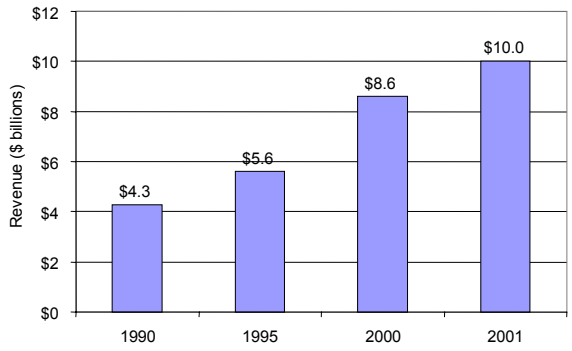


Fig. 3.13. Clean energy systems and power is the fastest-growing environmental industry segment. *Source*: EBI, Inc., June 21, 2002.

Trends

EBI reports that the big issues for the energy sector are energy supply and security and global climate change policy, and the business opportunities resulting from policies and business investments to address these. Energy sources, efficiency technology, conservation consulting, environmental equipment, and other sectors all face uncertainty and opportunity resulting from change in energy and climate change policy (EBI 2001a).

Clean Edge Inc., a market research firm focused on clean-tech markets, reports that the big growth trend is in "clean technologies." They forecast that the markets for clean energy technologies, while still nascent, will rise significantly, growing from less than $7 billion in 2000 to $82 billion by 2010. Wind power, solar photovoltaics, and fuel cells, in particular, are projected to experience double-digit annual growth. A number of factors are responsible for the rapid growth of clean-energy technologies, including security issues; energy uncertainty; the need for increased power reliability and quality; pressing environmental concerns such as global climate change, resource scarcity, and air and water pollution; technological advances; the rise of the developing world; strategic investors; government commitments; and venture capital. Although U.S. investments in clean-energy technologies have grown steadily over the past decade, a significant slowdown in investment occurred in 2001 reflecting changes in the overall equity markets due to the economic downturn. However, Clean Edge forecasts that over the near- to mid-term, clean-energy markets will regain their momentum. Projected market growth for select clean technologies is illustrated in Fig. 3.14 (Clean Edge 2002, 2001).

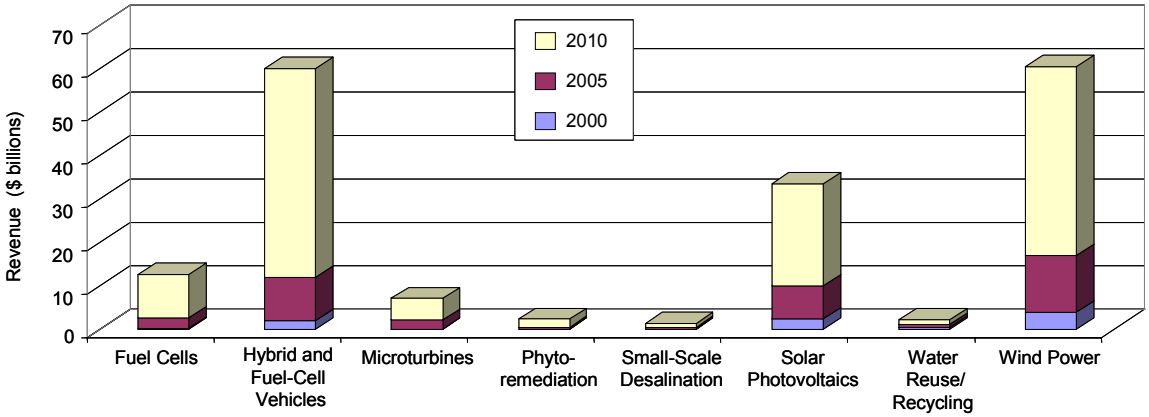
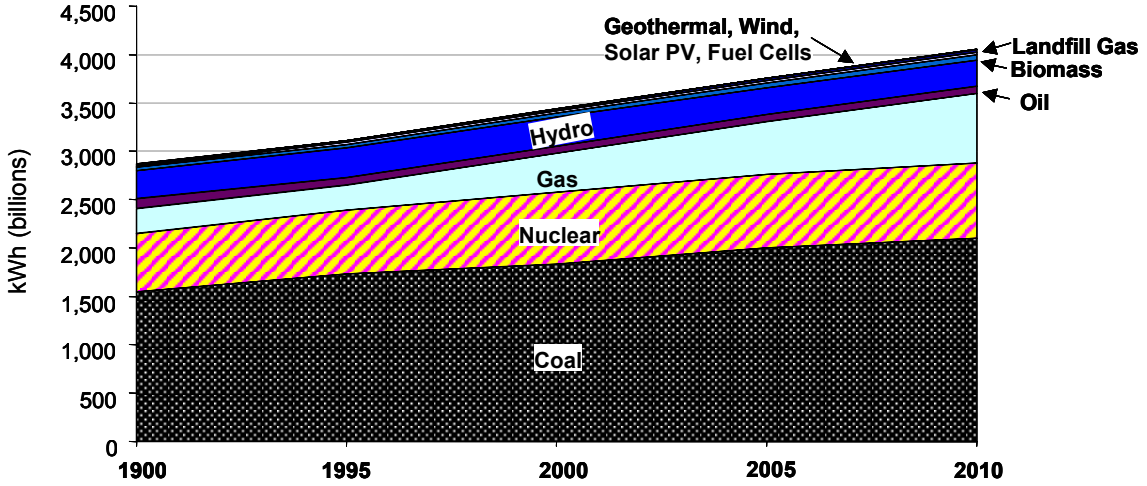


Fig. 3.14. Rapid growth is projected for clean technologies. *Source*: Clean Edge 2001.

Outlook

Energy supply, energy security, climate change, preference for clean alternatives, and rising fossil fuel prices lead to positive forecasts for clean energy, and this segment is projected to continue its reign as the fastest growing (percentage-wise) segment of the environmental industry. EBI reports that the goal of clean energy companies is to revolutionize the $3 trillion global energy business, and many experts see this as plausible. EBI projects that environmental energy sources will grow 256% from 2000 to 2010 (see Fig. 3.15). It will be fighting for share, however, with large, well-established coal and gas energy companies that are operating from positions of economic and political strength.



Energy sources	1990	1995	2000	2005	2010
Nonrenewable sources					
Coal	1,550	1,730	1,835	2,000	2,100
Nuclear	600	660	740	760	780
Gas	260	265	400	540	720
Oil	100	70	80	82	76
Subtotal	2,510	2,725	3,055	3,382	3,676
Renewable sources					
Hydro	293	311	302	277	263
Biomass	33	37	40	48	56
Landfill Gas	11	18	20	24	28
Geothermal	16	15	18	21	23
Wind	3	3	4	5	8
Solar PV	1	1	1	2	4
Fuel Cells	0	0	0	1	2
Subtotal	357	385	385	378	384
Total (billion kWh)	2,867	3,110	3,440	3,760	4,060

Fig. 3.15. Renewable (clean) energy sources should gain in importance over the coming decade, growing into significant businesses, albeit still small national contributors. *Source: Environmental Business Journal* 13 nos. 7–8 (2001).

3.8 U.S. Water Industry

Market Overview

The U.S. water industry consists of three EBI market segments: water utilities, wastewater treatment works, and water equipment and chemicals. The water utilities industry sells water to end users including consumers and all industries. Wastewater treatment works includes collection and treatment of residential, commercial, and industrial wastewaters. These facilities are commonly known as publicly owned treatment works or POTWs. Clients

include municipalities, commercial establishments, and all industries. Finally, the water equipment and chemicals industry provides equipment, supplies, and maintenance in the delivery and treatment of water and wastewater, for municipalities and all industries.

Together, these three market segments account for 2001 revenues of $80.0 billion and saw overall growth of 3% over 2000, a slowing relative to the 4–6% growth rates seen in 1994–1997 (Fig. 3.16). The actual size of the water industry is even larger, as water and wastewater revenues generated by the analytical services, consulting and engineering, and instruments and information systems segments bring the total U.S. water industry market revenues to $87.6 billion in 2001, or 41% of the $213.1 billion environmental industry total.

The performance of the individual segments was as follows:

- **Water equipment and chemicals:** Revenues in 2001 of $20.3 billion represent 2% growth from 2000, following 3% growth in each of the two previous years.
- **Wastewater treatment works:** Revenues in 2001 were $28.8 billion, a 4% increase over 2000. Growth in the two previous years was 2% (99/00) and 5% (98/99). Virtually all of these revenues (95%) are in POTWs.
- **Water utilities:** This segment generated $30.9 billion in 2001, which represents 3% growth over 2000 revenues. Prior years saw growth of 2% (99/00) and 3% (98/99).

Trends

Farkas Berkowitz reports that although the U.S. water market as a whole is growing very slowly, its internal structure is changing rapidly, driven by blurring of segment boundaries, consolidation, globalization, privatization and outsourcing, and technology. Segment boundaries are breaking down as firms diversify into new areas and the larger companies offer more integrated product and service contracts.

The ownership structure is also changing: U.S. firms are consolidating through mergers and acquisitions to form larger entities, and French and British water quality systems firms are penetrating the U.S. market. For example, Vivendi acquired U.S. Filter in 2000, combining

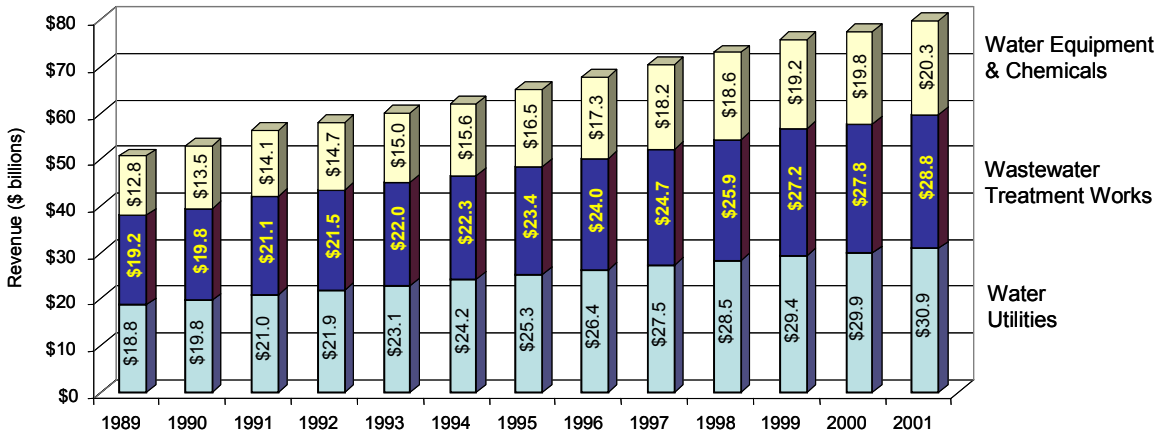


Fig. 3.16. Slow growth in U.S. water equipment and chemicals, wastewater treatment works, and water utilities. *Source: Environmental Business Journal* 11 no.7 (1998); 12 nos. 5–6 (1999); 13 nos. 3–4 (2001); and EBI, Inc., June 21, 2002.

the largest water firm in France with the largest water firm in the United States to create the largest water firm in the world. Indeed, Vivendi is now by far the world's largest environmental company.

Privatization in the government sector and outsourcing in the industrial sector are driving growth in the water industry. Privatization, in the form of design-build, is growing most rapidly. This represents a major break with the traditional design-bid-build model that municipalities have followed for the past century.

Two types of technological developments impact the water industry: information technology and e-commerce; and new and improved products, systems, and services. Although e-commerce is in its infancy in the water industry, the Internet and information technology generally are expected to have a profound impact on the future of the water industry. Longer-term, impending water shortages resulting from population growth and the diminishing availability of water suitable for an intended use (due primarily to pollution from industrial activities) will drive growth in markets related to water conservation, reuse, and reclamation.

Perhaps the largest issue facing the water industry is the need to upgrade the nation's existing water infrastructure, an undertaking estimated to require an investment of at least $200 billion (EBI 2001a).

Outlook

The outlook for the water market is driven by four key factors: economic recession, water security, continued consolidation, and increased penetration of the U.S. market by firms headquartered in Europe and the U.K. The effects of economic recession were in evidence in the financial results of water equipment firms, as potential customers cut back on unessential capital expenditures and postponed maintenance and repair expenditures. The water supply and wastewater treatment markets are recession resistant, but are being affected by September 11th when assuring the security of water supply facilities took on heightened importance. This creates a new market for consultants at the same time as it diverts management attention from other issues such as maintenance and repair of aging water infrastructure. Consolidation is expected to continue at a rapid pace for years to come. Finally, European and British firms are projected to dominate the water market in the United States (Farkas Berkowitz 2001). Overall, the water industry is projected to grow at roughly the rate of inflation.

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